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EXCAVATING ENGINEER

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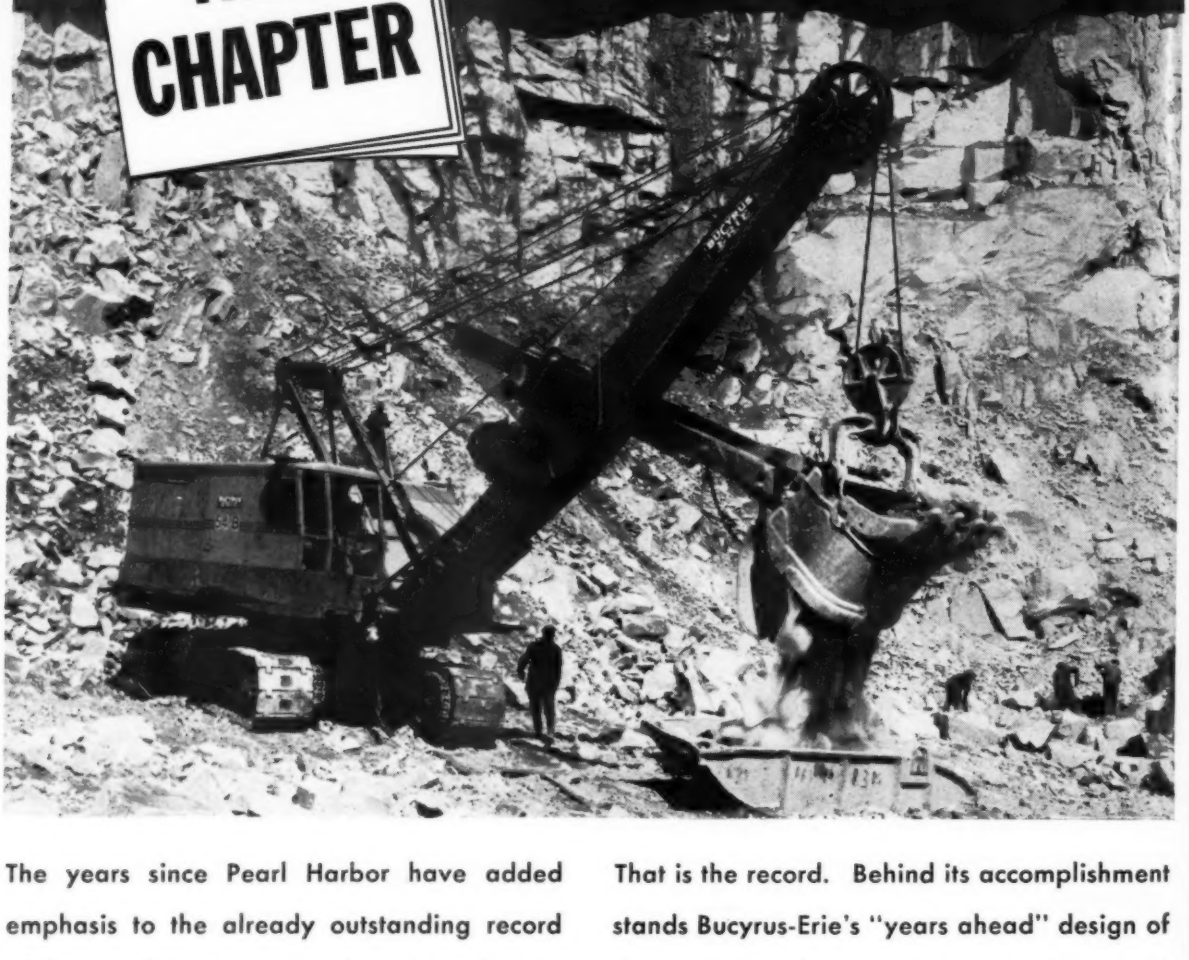
Rubble from a church ruined by bombing and shelling is loaded by this ½-cu. yd. shovel to a U. S. Army truck and used to repair roads in Aldenhoven, Germany.
(U. S. Signal Corps Photo)

VOL. XXXIX March 1945

A NEW CHAPTER TO AN OLD STORY



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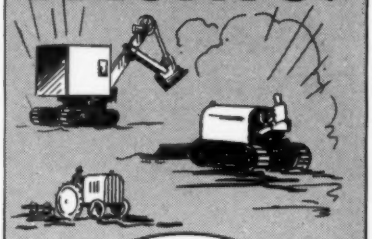

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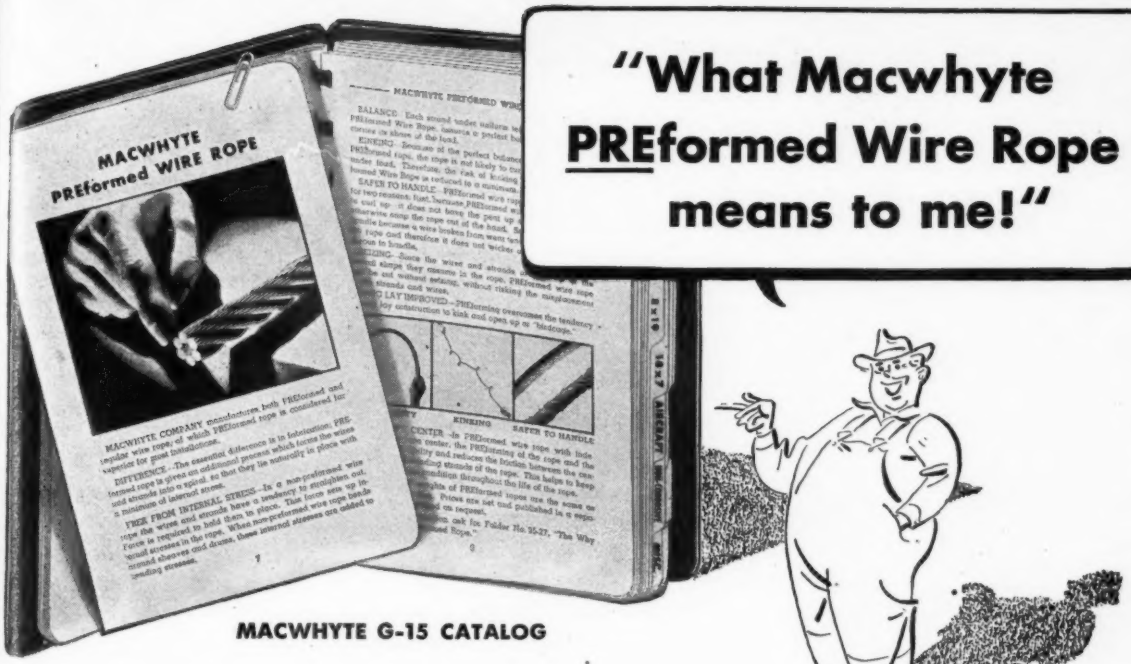

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Floating Drydocks for the Pacific

● Bucyrus-Erie 54-B crane lifting a wingwall truss into place.

SHORTLY AFTER the Japs struck Pearl Harbor, the U. S. Navy, Bureau of Yards and Docks, requested the Chicago Bridge and Iron Company to establish a shipyard on the Pacific Coast for the construction of floating steel drydocks. The drydocks were urgently needed by the Navy at Advance Bases in the Pacific, and the immediate problem was to select a site and start construction at the earliest possible moment.

A lightning survey was made in January, 1942 to find a location with the available manpower, housing, and other necessary facilities. Quickly selected as the site was a strip of sandy beach adjacent to the Northwestern Pacific Railroad Company's Main Line at Eureka, California. The Eureka area offered a pool of available manpower, then untapped by defense work, and housing was available to accommodate the estimated maximum working force of 1,000 men. The location was sufficiently remote to avoid undue competition for manpower with other shipyards and defense plants, which was an important consideration.

One of the first and most important problems in establishing a shipyard is the selection of the proper load handling equipment. In this case it was a question, not only of what type of equipment was best, but also of what could be obtained the most quickly. The original contract was for the construction of two large floating steel drydocks, a program requiring approximately 18 months to complete. It was not known at that time whether additional work might be assigned to the yard; but assuming that it might be, it seemed unlikely that all of the docks built would be duplicates of the first ones. It was considered desirable, therefore, to select a type of crane that could be readily adapted to any future variation in the layout of the yard. Because of this, and because they could be obtained and placed in service quickly, crawler cranes were chosen to handle all steel erection and other load lifting work at Eureka.

This decision was based on sound judgment because crawler cranes had been used by the Company for many years on large field erection jobs, and were then being used very successfully on similar work at its drydock construction yard at Morgan City, Louisiana.

A preliminary study indicated that

rawler cranes show excellent all-round utility value in handling usual steel erection job at Eureka, California Drydock Yard

By D. E. LARSON

(Resident Manager, Chicago Bridge and Iron Company, Eureka, California)

the heaviest loads to be handled in the construction of the drydocks then assigned to the yard were trusses weighing about 14 tons each. The cranes were chosen on the basis of this information and orders were placed in February, 1942 for two Northwest No. 6 cranes and two Northwest No. 71 cranes. By a fortunate coincidence, the first of these cranes arrived in Eureka on April 28th along with the first several carloads of fabricated steel from the Company's Chicago shop. The crane was assembled immediately and put to work unloading steel. The fitting and welding of preassembled pieces were started in May, and the keel for the first large drydock was laid early in June. This dock was completed, using the four Northwest cranes, and was delivered to the Navy on January 13, 1943, seven months after the keel was laid.

In the meantime contracts for more docks of different types to be constructed at the Eureka yard had been awarded to the Company, and the work of enlarging the yard and its facilities to accommodate the increased program was started in January, 1943. More cranes were needed to handle the augmented program and since the design of the new docks added to the schedule was such as to necessitate heavier lifts, it was evident that cranes having a greater capacity than the Northwests would be required. The new cranes consisted of one Manitowoc No. 3990 Speed Crane and four Bucyrus-Erie 54-B cranes. In addition to these cranes purchased for the job, a Lima Model 1201 crane was rented during the period of peak production.

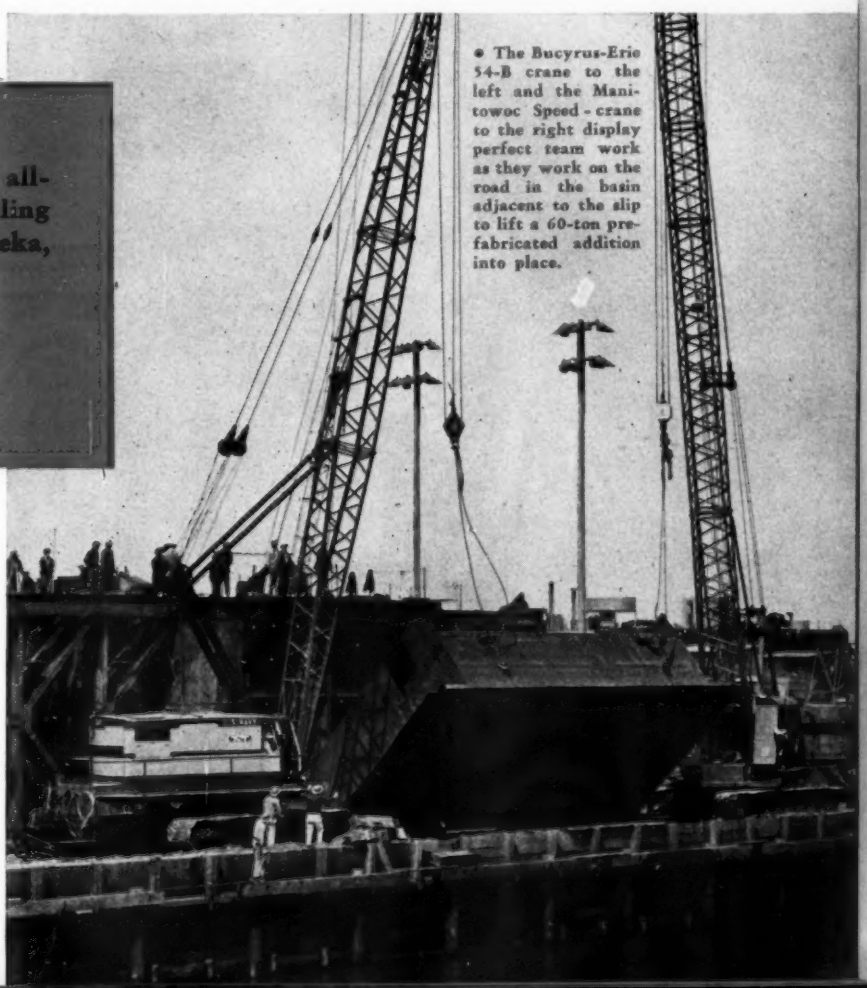
As the work progressed, it became evident that it was advantageous to erect the steel in the largest sections that could be handled after being preassembled and welded. In constructing the first dock, the main frames or trusses were preassembled and welded prior to erection but the hull was erected a plate at a time without stiffeners or reinforcing attached. By this method all of the plate seams had to be welded after the plates were in place on the dock. Experience showed that it was much simpler to weld several plates together on the ground and then weld the stiffeners to them before erecting the assembly. In this way most of the welding can be done down-hand, and the major portion of the welding shrinkage is allowed to occur before the plates are incorporated into the structure. The result is a more workmanlike job at lower cost. When the yard was enlarged, five Unionmelt automatic welding machines were purchased and these machines could be used to the greatest advantage in welding the seams of preassembled sections on the ground.

This trend resulted in the preassembly of a great many sections too large to be handled by a single crane. Some preassembled sections weighed as much as 60 tons. Such sections are raised by two cranes acting in unison. Although this operation requires the closest team work, it has proved very effective and no accidents have resulted from the failure of the two participating cranes to work together properly.

Hull plates and other assemblies are fitted together and welded on a grillage of horizontal timbers, commonly referred to as a preassembly slab. The sections are then loaded onto cat wagons and hauled by tractors to the dock of which they are to become a part. The cat wagons originally purchased for the Eureka yard had a load capacity of ten tons each and were, therefore, unsuited to the handling of heavier preassembled sections. The hauling problem was solved by securing some heavy duty caterpillar tracks and constructing two special cat wagons, each capable of transporting a 60-ton load.

Three different schemes of launching have been utilized for the various drydocks constructed at Eureka. One group of small drydocks was built on ways designed for end launching. This scheme proved to be very satisfactory because the crawler cranes had access to roadways along both sides of each dock under construction and could, thus, easily handle loads to any part of the structure.

It is customary to build ships on an incline parallel to the slope of the launching ways. Each of these small drydocks, however, was built with its keel level. This made it much easier to plumb the structure as erection proceeded and to set all machinery



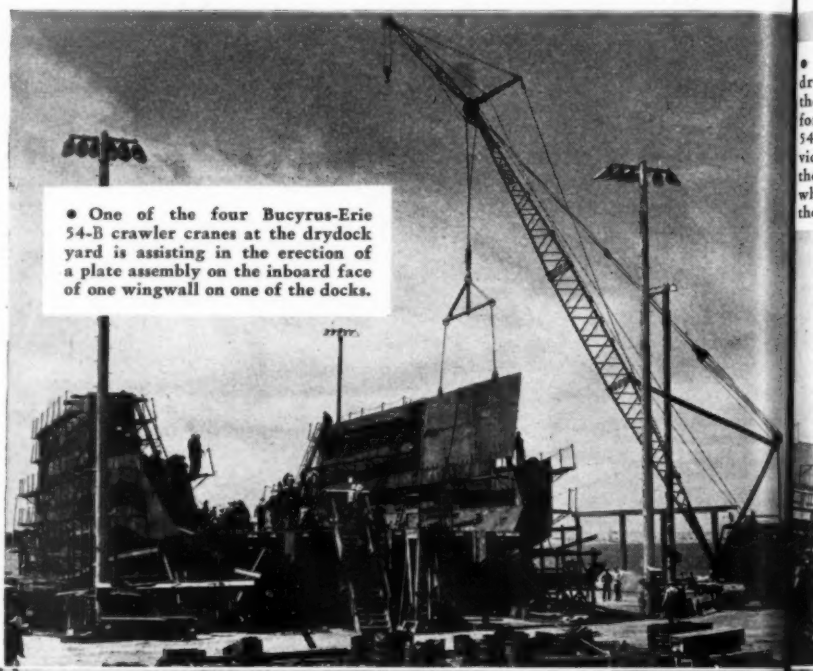
• The Bucyrus-Erie 54-B crane to the left and the Manitowoc Speed-crane to the right display perfect team work as they work on the road in the basin adjacent to the slip to lift a 60-ton prefabricated addition into place.

bases accurately. During the launchings, the docks slid down the ways on timber launching cradles, whose bottom member was a timber runner bearing on the greased launching way and whose top member was a horizontal timber supporting the bottom of the dock.

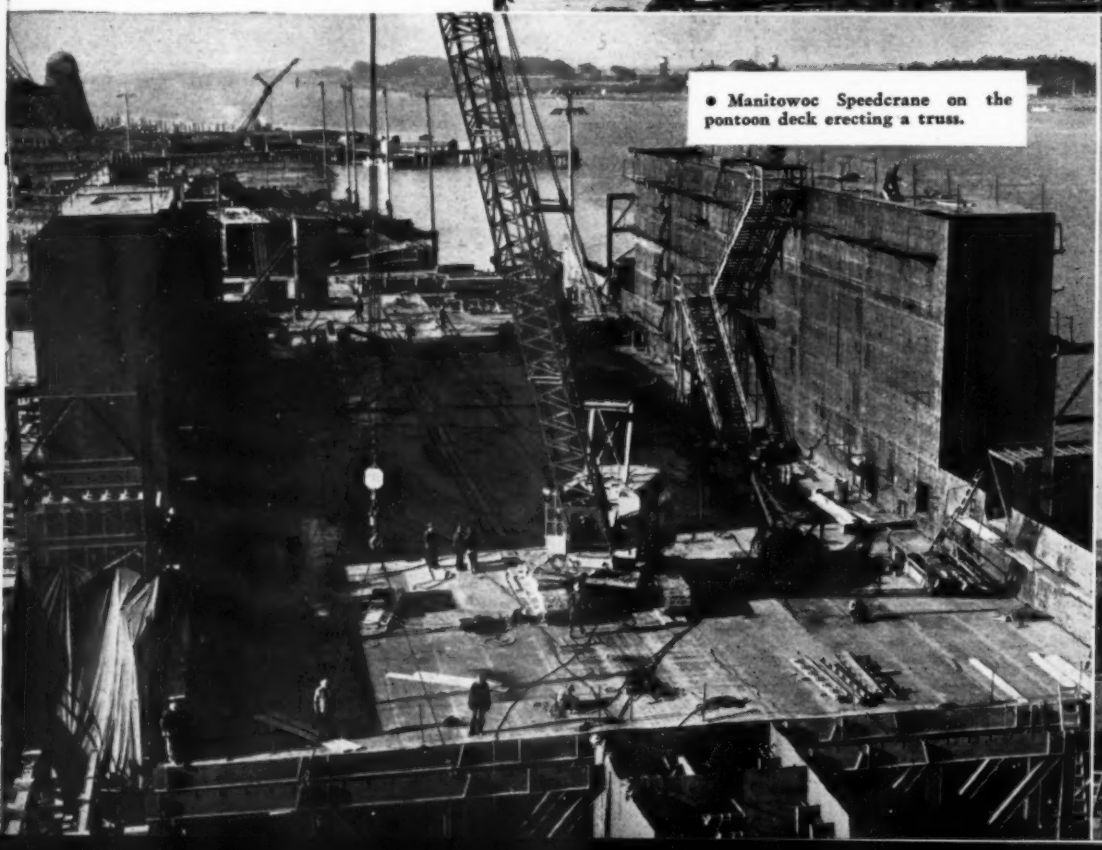
The largest of the drydocks constructed at Eureka were built in three sections, consisting of one large center section and two smaller end sections. By contrast with the smaller docks each of these larger sections was launched sidewise into the Bay. This meant that during construction the larger sections were accessible only from the land side. In order to handle the heavy lifts near the water side, a crawler crane was moved along the center line of the dock on mats laid on the longitudinal stringers which support the buoyancy chamber of the dock during construction. This arrangement utilized a Bucyrus-Erie crane to lift a prefabricated section of the buoyancy chamber into place in one of the early stages of erection.

After a portion of the buoyancy chamber has been erected, the crane is moved up a ramp under its own power to the pontoon deck on which it is in position to make all other lifts required to complete the structure.

A third type of launching scheme has been used in connection with all of the sectional docks built at Eureka. These docks are made up of a number of sections which are built as individual units towed as such to Advance Bases, and there assembled into a complete structure capable of docking some of the largest ships afloat. At Eureka these sections are constructed in pairs in a shallow dry basin adjacent to a deep slip containing water. The basin and the slip are completely enclosed in a double walled cofferdam. When the dock sections in the basin are ready for launching, the basin and slip are both pumped full of water to the top of the cofferdam. The depth of water is sufficient to lift the sections off their construction berths and when afloat, they are moved from the basin to the slip by simply pulling them sidewise with cables from two of the crawler cranes. When the sections have been moved into the slip, the water is siphoned back down to its normal level. This leaves the basin dry again, thus allowing two more sections to be



• One of the four Bucyrus-Erie 54-B crawler cranes at the drydock yard is assisting in the erection of a plate assembly on the inboard face of one wingwall on one of the docks.



• Manitowoc Speedcrane on the pontoon deck erecting a truss.

started on the construction berths while the work of outfitting is carried forward on two sections floating in the slip. When these sections are ready to be moved from the slip into the Bay, a portion of the cofferdam wall between the slip and the Bay is removed and the sections are towed out through the opening, one at a time. It should be mentioned that the bottom of the basin is at an elevation high enough to prevent it from being flooded by the water in the slip at high tide.

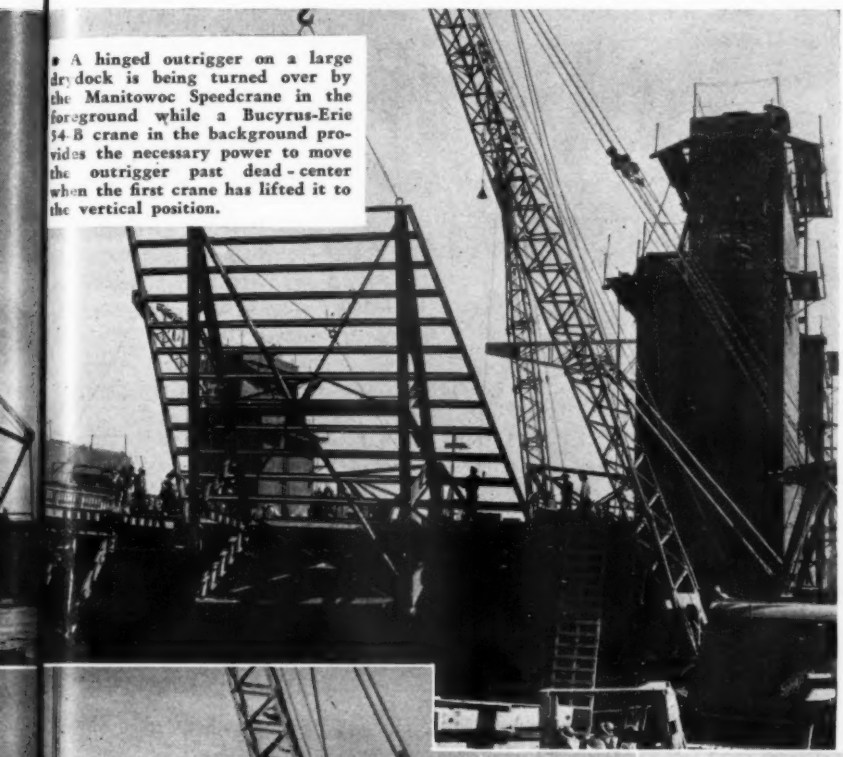
This construction and launching arrangement has several desirable features. Practically all launching hazard is eliminated by virtue of the fact that all parts of the launching operation can be accurately controlled. No part of the procedure is left to chance. The basin arrangement is ideal for construction purposes because it contains roadways which give the cranes a working access to both sides of each dock section.

The double-walled cofferdam enclosing the basin and slip had a width sufficient to permit any of the crawler cranes to operate on top of it at any point. The cofferdam is designed to withstand the pressures resulting from such loads.

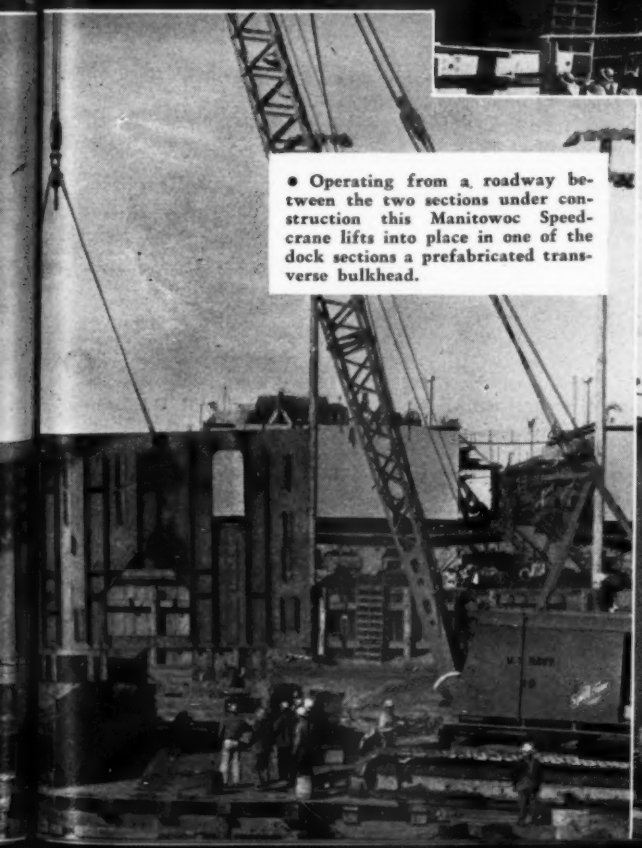
The flexibility provided by its fleet of crawler cranes has been an important factor in the efficiency and successful operation of the Eureka yard. Since its start the yard has been enlarged several times and in each case it has been possible to make the necessary changes without expensive revisions in permanent crane facilities. The crawler cranes have been readily adapted to each new type of work assigned to the yard. With this type of crane, it is possible to schedule the work so that each one can be used to the greatest possible advantage. If a particular crane is not needed in one part of the yard, it can be quickly moved to another where it is needed. This makes it possible to operate all cranes at maximum efficiency.

A crawler crane can be moved to almost any spot where it is likely to be needed. Cranes are moved down a ramp from the pontoon deck of two dock sections which are about to be launched. A timber trestle between the two sections allows the crane to be moved from one to the other as needed during construction.

The experience with crawler cranes at Eureka has been very satisfactory and they are considered to be ideal for an operation of this sort which is definitely temporary in nature.



• A hinged outrigger on a large dry dock is being turned over by the Manitowoc Speedcrane in the foreground while a Bucyrus-Erie 54-B crane in the background provides the necessary power to move the outrigger past dead-center when the first crane has lifted it to the vertical position.



• Operating from a roadway between the two sections under construction this Manitowoc Speedcrane lifts into place in one of the dock sections a prefabricated transverse bulkhead.

• The Manitowoc Speedcrane is lifting a "cherry picker" over the wingwall of a large dock to enable it to be used in setting keel blocks and bilge blocks on the pontoon deck.

Weggum Mine

By HENRY HUGHES
(Industrial Relations Manager, Butler Brothers, Cooley, Minn.)

• Looking north across the Weggum Mine pit nine months after start of operations by Butler Brothers. One shovel is loading overburden to 15-ton Euclid trucks which haul it out of the pit along the road in the center background. The other shovel is working in ore that is being trucked to the drive-over screening plant (right foreground) which is built against the south wall of the pit.

WHEN THE LEASE on the Philbin Mine was taken by the Philbin Mining Company in 1942, Butler Brothers, one of the largest independent producers of iron ore in America, as operators of the mine, not only changed the mine name, but also its method of operation.

This mine which is located on the Mesabi Range off the east end of the Hull-Rust-Mahoning-Susquehanna pit near Hibbing, Minnesota, was opened by the Oliver Mining Company in 1914 as an underground mine. From 1915 to 1925, 1,235,910 tons of iron ore were shipped. In 1926 the lease was surrendered to the State of Minnesota. For 16 years the mine lay dormant until the lease was taken by the Philbin Mining Company in 1942.

The name of the mine was changed to "Weggum" in honor of the Weggum brothers, Christ, Gust and Ole and their sons, Peder, Per, Paul and John who together have contributed a century and a half of service to the company.

Butler Brothers changed the method of operation at Weggum Mine to a modern open pit operation. To change an iron mine from an underground to an open pit operation requires much preparatory work especially in the matter of exploration. Underground iron mining must necessarily confine its production to either merchantable ore or to the highest grade of wash ore. Open pit mining methods have made it possible to profitably handle ores of much lower grade. Therefore, the exploration work must be much more thorough. The property was explored by diamond, structural and churn drills prior to the opening of the mine.

Because it was formerly operated as an underground mine and because of its restricted area, the Weggum Mine could not be operated by steam haulage. It was, therefore, made into a modern truck operation. Twenty-two 15-ton back dump Euclid trucks, three Caterpillar RD-8 tractors and bulldozers and a motor patrol were necessary to keep the two shovels working steadily.

On January 14, 1943 the first shovel, a Bucyrus-Erie 120-B four-cu. yd. electric, dug its first dipperful beginning the job of moving 6,500,000 cu. yds. of overburden. By January 18, a Bucyrus-Erie 120-B 4½-cu. yd. electric shovel was in position and loading. The haul road to the dumping area, at the start of operations, was 1½ miles long. This is an unusual distance for trucks to transport this much overburden, but it was made necessary by the location of this property. As the work continued, this haul, which used two bridges to cross highways, was shortened to an average of about a mile in length. Each truck handled three dipper loads per haul. In January and February a small warehouse, office and shop were constructed.

The Weggum Mine was started in the middle of winter under adverse conditions. The weather was extremely cold, with the temperature on many occasions dropping to 30 degrees below zero. Due to this, frost conditions were encountered right from the start.

• Another general view of the pit showing the screening plant from the pit floor. The shovels are Bucyrus-Erie 120-B, 4-cu. yd. and 4½-cu. yd. electrics and the drill in the foreground is a Bucyrus-Erie 27-T.

The conveyor in the center brings ore from the screening plant to the stacker and concentrator at the top of the pit.

tler Brothers take over ine opened by Oliver Iron ining Company in 1914 as underground mine, change ame to "Weggum" and lopt modern open pit meth- s and truck haulage at art of operations in 1943. e Bucyrus-Erie 4 and 4½- . yd. electric shovels to ove 4,343,014 cu. yds. of aterial and ship, 1,025,631 ns of ore from January, 1943 to January 1, 1945.

To overcome frost, two Bucyrus-Erie 27-T churn drills were used all winter. The holes were drilled generally about ten feet deep and about 15 to 20 feet apart. Generally 25% gelatin was used for blasting the frost holes and the amount used depended upon

• Two of the 22 15-ton Euclid trucks dumping overburden from the Weggum Mine.

• Above: Diamond drills and structural drill doing exploratory work in January, 1943, prior to the opening of the open pit mine. Left: Bucyrus-Erie 27-T churn drill used to overcome frost conditions encountered at the start of Butler Brothers operations at the Weggum Mine.

the depth of the frost. In addition a large number of huge boulders were found in the gravel that comprised part of the stripping. The boulders were cast behind the shovels, grouped together by a bulldozer then drilled by jackhammers. The air for the jackhammers was furnished by portable compressors which were hauled to wherever needed by a bulldozer. The jackhammers drilled 2-inch holes which were each loaded with about half a stick of 1¼-inch 60% dynamite. The holes were drilled 12 to 18 inches in depth depending on the size of the boulder.

The east end of the pit was a swamp with muskeg from five to 20 feet deep with a layer of blue clay of about the same depth underneath. This formation extended along the north side of the pit. On the north side an old dump covered the area to be stripped — over the property line onto the south Longyear property where a dirt dump had been placed about 1911 when the Longyear mine was stripped.

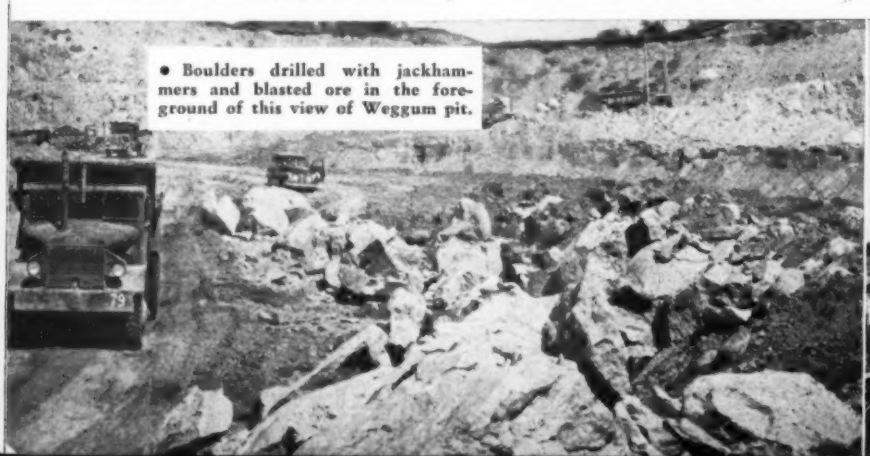
In this area there was considerable water in the surface which made work difficult for the shovels.

In addition, due to the nature of the ground many small slides occurred that sometimes would bury the front or side of the shovel. The trucks also found it difficult to make headway under these conditions and at times had to be pulled away from the shovel by bulldozers. Since the adjoining pits are lower than the Weggum there was natural drainage from the Weggum and no pumps were needed.

On the south and west side of the pit the stripping was composed mainly of gravel. Occasional pockets of good road gravel were found. When this happened, the gravel was loaded to trucks by the stripping shovel and stockpiled on the surface for future surfacing of the haul roads.

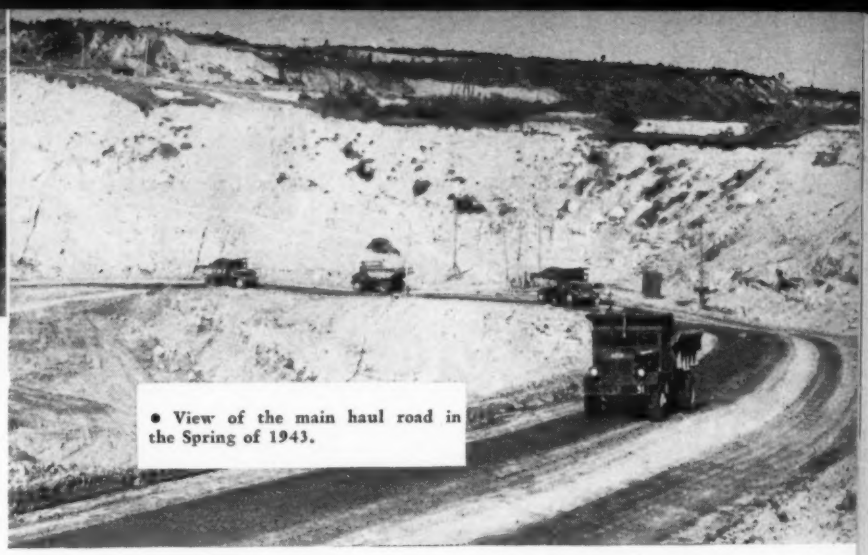
Despite the handicaps imposed by nature, the work progressed. After the middle of March, when the frost drilling was completed, the drills were moved into the taconite and paint rock and continued their drilling. In the taconite and paint rock blast holes were drilled 15 to 20 feet apart, depending on the material, and 30 to 40 feet deep. Twenty-five per cent gelatin and No. 4 bag powder were generally used for blasting. The amount of powder used depended on the depth of the hole and kind of material being blasted. Enough holes were blasted at a time to keep the shovel in broken material. By the latter part of April the shovels were working in paint rock and taconite ranging in depth from 30 to 40 feet which overlay the ore formation. Paint rock becomes very slippery when wet and much difficulty was had in keeping up roads during wet weather. When roads on paint rock became bad due to water and wet weather, they were scraped off by a bulldozer and grader and a covering of taconite was laid on the sub-grade. The taconite was then covered by a finer material from the pit, usually lean ore or dry paint rock. No gravel was allowed on the roads in the ore pit.

For sufficient dumping area a quarter section lying one-half mile south of the property was taken under lease. This area was divided into three



• Boulders drilled with jackhammers and blasted ore in the foreground of this view of Weggum pit.

• Bucyrus-Erie 4½-cu. yd. electric shovel loading paint rock to a 15-ton Euclid dump truck. Three dipperfulls make a truck load.



• View of the main haul road in the Spring of 1943.

dumping groups: one dump containing only surface stripping and lean taconite, another composed of taconite only and the third made up of lean ore and paint rock.

When the Weggum stripping got underway in January, 1943, it was found that it would be necessary to use a dump in conjunction with the Susquehanna Mine. The haul road to this dump passed over a single lane bridge over a Village of Hibbing road. The single lane bridge constituted a bottle-neck inasmuch as only one truck was able to cross the bridge at a time. To correct this situation permission was obtained to replace this bridge with a fill wide enough for a double lane road. The wider road eliminated the slow-down caused by the bridge and also the hazard to truck drivers who sometimes blinded by the oncoming trucks had difficulty in judging their approach to the bridge.

Stripping was carried on three shifts per day, 8 a.m. to 4 p.m., 4 p.m. to 12 m, and 12 m to 8 a.m. During the first year ore was loaded as needed until the wash plant was built and then ore was loaded three shifts per day.

In the spring the engineers laid out the site of the washing and drying plant, the railroad yards and loading pocket. By June, 1943 the plant construction work had started and the washing plant produced its first ore on September 8.

When the shovels had dug down to the ore, it was necessary for the engineers to stake out the underground drifts in order to prevent the shovels from falling into them. The drifts were generally full of water which caused the pit to become very muddy.

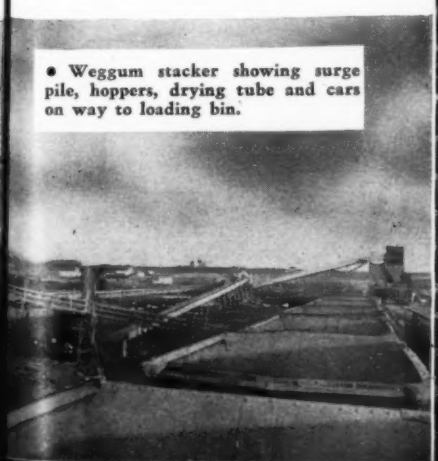
The drive-over type of screening plant was built in the pit against the south wall. This type of plant utilizing a bridge over the pocket eliminates the backing-up method of dumping and makes a more efficient operation. Part of the bridge over the pocket is a pair of air-operated gates over which the trucks can be driven. The driver proceeds on the bridge until the front wheels rest on the top of an 18-inch camel back. This elevates the front of the truck and saves wear and tear on the hoisting mechanism and also speeds up the process of dumping. The driver knows where to stop his truck because the back wheels drop into a slight depression which holds the truck from rolling backward into the pocket.

The ore is dumped into the screening plant where it passes through the screen and goes on the main conveyor belt. On its rise from the pit it is carried through two large concrete tunnels constructed under the haul roads. One thousand feet of conveyor are required to take the ore to the stacker at the concentrator.

The stacker, a 55-foot high steel skeletal structure, was built in order to provide surge piles from which a

(Continued on page 160)

• Below: Ore dumped into the screening plant goes on the main conveyor belt and on its rise from the pit is carried through two large concrete tunnels, constructed under the haul roads. Right: This 55-foot high steel skeletal stacker was built to provide surge piles from which a steady flow of ore could be fed to the washing or drying plants. (A) is the shuttle belt and (B) the cross-running belt.



• Weggum stacker showing surge pile, hoppers, drying tube and cars on way to loading bin.

Safety Factors in Arc Welding

By R. F. WYER
(Application Engineer, Electric Welding Division, General Electric Company)

Judged by industrial standards arc welding is not a hazardous occupation and electric shock is a relatively infrequent cause of death, but maintenance and supervision play an important part in the safety side of welding.

THERE IS ONE PECULIARITY which distinguishes the arc welding operator's job from other occupations. Arc welding is the only widely practiced industrial occupation in which the operator handles a live electric circuit all day. Yet, in spite of all the implications of that fact, the danger of electric shock to the operator is not as great as is often supposed.

This article treats safety factors in arc welding from the electrical point of view. There are, of course, other view points. For example, the arc welding operation involves some fire hazards, as well as the ordinary mechanical hazards to the workman which are common to almost any industrial or construction occupation. But these are not peculiar to arc welding.

The presence of fumes and smoke is likewise not peculiar to the arc welding process, and ordinary means of dilution and removal are employed. The medical aspects of this matter are the subject of careful investigations in a quantitative way, but they all point to adequate ventilation as the practical hazard - preventative measure.

Radiation of ultra-violet and infrared wave lengths from the arc are sometimes regarded as serious hazards. They are not, in the sense that their effects can easily be prevented by commonly used protective helmets and clothing. Mystery rays are not present, although it is surprising how any times the rumor crops up that or that arc welding equipment off radiations which result in or peculiar ailments such as attributed to X-rays. Our own plant in Schenectady has effectively disposed of such rumors by having welding operators carry in their clothing pieces of photographic film for weeks at a time. None showed the slightest evidence of radiation.

Hazard of Electric Shock

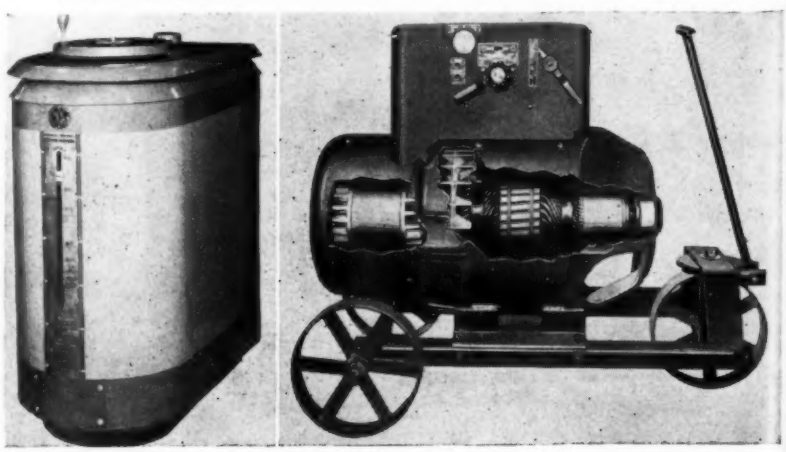
Thus, the hazard of electric shock is the one of greatest interest from the arc welding point of view. It is not as common a source of injury or death as might be supposed from casual acquaintance with the subject, but there are definite ways in which even the small hazard can be almost completely overcome.

We have tried to keep records, and make a study of fatalities to welding operators from electric shock. It is a difficult task, because insurance statistics are not broken down quite far enough to reveal the needed data, and also, rumors and newspaper publicity are notably inaccurate when dealing with deaths in the arc welding field.

But we do have some concrete information, and it shows a perhaps surprisingly small number of fatalities from this source. One insurance company[1] reported that among one group of policy holders, electric shock was the least frequent cause of occupational death classified — fewer deaths being attributed to shock than to falls, machinery, railroads, or even drowning. This in spite of the fact that the group must have included electricians and workers in electrical manufacturing plants, and in spite of the often evidenced tendency to at-

[1]Safety Facts, 1942 Edition, Page 70.

• Left: Cut-away view of a single-operator d-c portable motor-generator arc-welder. The motor is at the left and the d-c generator at the right of the assembly. Insulation around the winding of the motor, and additional insulation on the generator, effectively separates the power-circuit voltage and the welding circuit. Right: Outdoor form of an a-c welder including a welding transformer, together with a built-in control panel which automatically reduces the voltage on the welding circuit to about 30 volts within 1/15 of a second after the welding arc is extinguished. Touching the electrode to the work automatically puts full power on the welding circuit again.



tribute death to electrocution in any doubtful case where a live electrical conductor is present at the scene.

In a survey which we made among four manufacturers using arc welding, selected at random and not including General Electric, these figures were obtained for the year 1941: There was a total of 14,475 industrial workers employed by the four manufacturers, with a total of 13 fatalities, or one death per 1110 workers. Included in these totals were 1125 arc welders, among whom there was one fatality.

Our own plants have for many years employed arc welders, with as many as 1500 welding operators employed at one time before the peak in this employment. Yet in the last seven years there has been but one fatal accident to a welding operator. This one was in 1938, and there is considerable doubt as to whether death was caused by electrocution or by a fall.

The district supervising engineer of one large insurance company[2] stated in 1942 that, as measured by compensation rates, arc welding is only 75 per cent as hazardous as gas welding. Yet gas welding is not generally considered a very hazardous occupation.

In 1942, still another insurance company[3] reported about one electrocution case per month for the preceding two years, only two of which involved arc welding. These two cases were the only ones they had had for many years.

While no figures on the total employment of arc welding operators are available, a conservative estimate based on industry sales of arc welding equipment and on the consumption of electrodes gives a figure well over 200,000 for 1943. So far, we have heard of only four electrocutions among arc welding operators during that year.

The shock hazards which do exist might be classified as to their relationship to equipment and its layout, maintenance, supervision, and operator education.

Hazards of A-C, D-C Welding

There is the perpetual question as to the relative hazard in a-c and d-c welding. Exhaustive studies on let-go currents, made at the University of California, definitely prove that under laboratory conditions, a victim is less likely to freeze onto an electrode with d-c than with a-c, at a given current in milliamperes. But to draw the conclusion that d-c welding is invariably safer than a-c welding is to ignore the factors of voltage, insulation, protective equipment, skin resistance, and physical condition of the subject.

The extremes to which interpretations of these tests may go is indicated by the recent development of a theory, by a welding supervisor, that while 24 volts is safe, 28 volts is dangerous. Or by the performance of another welding supervisor, who knelt in water on a steel deck and grasped an electrode with soaking wet gloves, to demonstrate that one can feel 35 volts, but not 10 or 12. If such a demonstration ever convinces a welding operator that it is safe to place the body intentionally across any electrical circuit, it may well be a contributing factor to his untimely death.

Among the welding equipments we are mainly concerned with is a single-operator d-c welder. The motor usually operates on 220, 440, or occasionally 550 volts, three-phase, a-c. The generator delivers from 50 to 100 volts, d-c. Insulation around the windings of the motor, and additional insulation on the generator, effectively separates the power-circuit voltage and the welding circuit.

A common type of a-c welder transforms energy from the power system into lower voltage and higher current, with control of the current output to suit it to the welding process. This equipment also insulates the power circuit from the welding circuit. The input, or power circuit winding, is electrically separate from the 75-volt welding circuit winding.

Another form of a-c welder, designed particularly for outdoor service includes a welding transformer like the indoor type, together with a built-in control panel which automatically reduces the voltage on the welding circuit to about 30 volts within one-fifteenth of a second after the welding arc is extinguished, as when the electrode must be changed. Touching the electrode to the work automatically puts full power on the welding circuit again.

With respect to the installation of

• An ideal set-up for potential trouble. The operator is in a cramped space, and also in contact with the conducting metal in a number of places on his body, unless his clothing is dry and his shoes free of nails. He holds an electrode holder with a handle of insulating material, but through which extends an uninsulated screw-head. Probably contact with the screw would be too small in area to permit electrocution, but a shock may make him do something involuntarily, which would put him in danger. Also, each time the operator changes electrodes there is the chance he will contact the exposed metal, and if he should fall on the holder, or sling the cable over his shoulder or around his neck, this live conductor may contact his chest or back.

[2]Private Communication, May 11, 1942 (The Travelers, Hartford, by Geo. F. Skelly, District Supervising Engineer).

[3]Private Communication, May 29, 1942 (Liberty Mutual Ins. Co., Boston, by David T. Shute, Service Supervisor, Loss Prevention Dept.).

• An arc-welding operator should be particularly careful when working above the ground since many fatalities are caused by falling.

• Danger ahead. The insulation of this electrode holder is broken.

arc welding equipment, the major safety point is the necessity of grounding the frame of the welding set, regardless of whether it is an a-c or d-c unit, or whether it is stationary or portable. Common sense, as well as the National Electrical Code, demand that this should be done. An ungrounded unit, even one in perfect condition, can give annoying shocks and tickles to a grounded individual, because of the inherent ability of an electrical circuit to induce a static charge on another conductor separated from it by insulation. The effect is the same as that in a condenser, or Leyden jar.

Insulation Failure

In the event of failure of the insulation, due to age, abuse, or accident, the frame of a unit may become charged to full power circuit voltage, with serious consequences, unless the frame is grounded. If the proper ground connection is in place, however, the frame cannot have a voltage to ground, and the only effect of such a failure will be the blowing of fuses or tripping of circuit breakers and disconnection of the unit from the line.

This immediately suggests the necessity of installing adequate overcurrent protection and switches in the power circuit to the welder. Fuses or circuit breakers must be capable of interrupting the maximum current which may be drawn by a short circuit in the motor or power leads of a d-c welder, or in the primary circuit of an a-c welder. Disconnecting switches must be capable of interrupting the stalled rotor current of the d-c machine, or the maximum current which can be drawn by the a-c unit when the welding electrode is short-circuited on the work.

On the welding-circuit side of a unit, care should be taken to avoid the possibility of getting double the normal circuit voltage between two adjacent welding circuits, because of the connection of one unit with one polarity, and the other with opposite polarity. On a-c units, abnormal voltage of somewhat lower value can also be obtained if adjacent welders are operated from different phases of the suppply line. This factor has rarely, if ever, caused serious trouble because of the small likelihood that an operator will get hold of two welding circuits at once.

• Bridge girders 120 feet long for 15-ton mill-type crane being fabricated with aid of G-E alternating-current arc welder. These longest "all-welded" crane girders ever built weigh 36 tons each.

The Electrode Holder

Probably the most important item in equipment, from the safety point of view, is the electrode holder. Although uninsulated holders have been used in arc welding for many years, good practice unquestionably requires that fully insulated holders should be used.

There are now several types of good insulated electrode holders on the market. They should be used on any welding job, and their insulation should be kept in first-class condition. Studies of accident reports reveal, in a good percentage of cases, evidence

that uninsulated electrode holders caused or contributed to death.

Maintenance and Supervision

Maintenance and supervision play an important part in the safety side of welding, as is the case in almost any other process. Fire hazards should obviously be watched for and, when found, eliminated. Welding cables and their connectors should be examined frequently for breaks in insulation. The extremely hard service to which welding cables are subjected often results in severe damage to the insulation. Yet the welding operator, accustomed to arcs and sparks in his daily work, often disregards accidental short circuits which spell trouble to the safety man or the fire inspector. Likewise, welding return circuit connections should be given attention, by the supervision. Arcs or flashes in unexpected places along the return path of the welding current may result in fire hazards if reinforcing rods, scrap lengths of pipe or bar laid together, or building piping are indiscriminately used.

The maintenance of adequate safety ground connections to the frames of all welding machines should be checked, because many operators do not realize their importance. For the same reason, the maintenance of insulation on electrode holders should not be left to operators alone. Electrical repairs and connections on the power-line side of the welder should be handled only by competent men.

In the last analysis, it is obvious that the welding operator and his safety education play the greatest part in preventing accidents to himself. It is undoubtedly significant that at least one—there are probably others—of the large electrical manufacturing concerns has an unusually good accident record in regard to shocks to welders. Regardless of special instructions, the whole philosophy of such a group of workers leads to a healthy respect for all electrical circuits and proper care in handling them.

Extra Care Needed in Hot Weather

The paramount warning should be to take particular care in hot and humid weather, and when welding in wet places. Almost without exception, fatal accidents to welders occur in hot weather. The operator's own condition and that of his clothing should be his guide. He should always guard against wet gloves, shoes, and clothing, particularly clothing made of thin cotton fabrics.

The operator should assume the major responsibility for seeing that the insulation of the electrode holder is in good condition.

He should learn to carry an electrode holder by the handle, never slung over his shoulder, or squeezed under his arm.

He should never, under any circumstances, transport an electrode holder with an electrode or electrode stub in it.

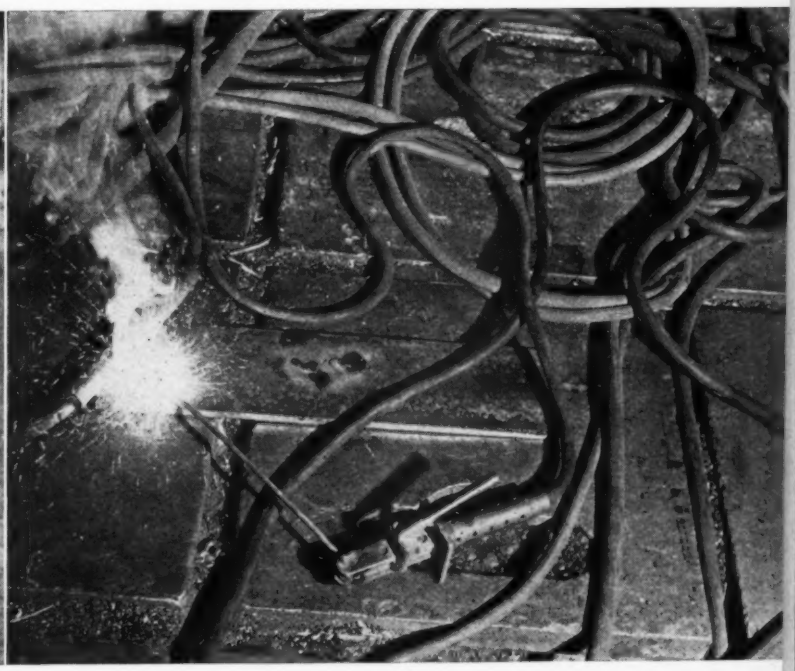
He should never throw or lay an electrode holder down so that it makes contact with any conducting material.

He should never work alone in con-

(*Continued on page 166*)

• Trouble ahead for this operator who should never sling an electrode holder over his shoulder, or leave an electrode in a holder when not in use.

• This operator is inviting trouble with the uninsulated holder and the cables coiled carelessly under feet and legs, ready to trip him when he rises.



• Electrode holder should never be thrown or placed where it can make contact with conducting material.

Excuses for Delay in Performance of Government Contracts

By ROGER SHERMAN HOAR
(Commercial Attorney of Bucyrus-Erie Company)

THE OCCURRENCE of unusual and unexpected events is no excuse for delay in performing a Government contract.

The Supreme Court of the United States, in **United States** vs. **Brooks,** 318 U. S. 120, on February 1, 1943, handed down an important and far reaching interpretation of Article 9 of the Standard Form of Government Construction Contract (War Department Procurement Regulations 1302.9).

The contractor, in a levee contract, had been delayed 183 days by floods, which the Contracting Officer ruled could have been foreseen. Accordingly $3,660 in liquidated damages at $20 a day was withheld. The contractor sued in the Court of Claims, and was awarded the $3,660, but the Government took the case to the Supreme Court, which reversed the court below.

Article 9 gives the Government the option of terminating the contractor's right to proceed, or of allowing him to proceed subject to liquidated damages, if he fails to work with diligence or to complete the work on time. The first proviso reads:

> **"Provided,** That the right of the contractor to proceed shall not be terminated or the contractor charged with liquidated damages because of any delays in the completion of the work due to unforeseeable causes beyond the control and without the fault or negligence of the contractor, including, but not restricted to, acts of God, or of the public enemy, acts of the Government, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and unusually severe weather or delays of subcontracts due to such causes: . . ."

The Supreme Court held that this means that fires, floods, epidemics, etc., are an excuse only if they are "unforeseeable" and also are "beyond the control and without the fault or negligence of the contractor." Justice Murphy, who wrote the opinion, quotes with approval from the dissenting opinion of Judge Madden in the Court below, as follows:

As a result of a recent Supreme Court interpretation of Article 9 of the Standard Form of Government Construction Contract, contractors are advised to be sure to include in their bids the express condition that the word "unforeseeable" and the 10-day reporting provision be omitted or deleted from the Delays-Damages clause, and not to accept the contract unless this deletion or omitting has been done.

> ". . . Not every fire or quarantine or strike or freight embargo should be an excuse for delay under the proviso. The contract might be one to excavate for a building in an area where a coal mine had been on fire for years, well known to everybody, including the contractor, and where a large element of the contract price was attributable to this known difficulty. A quarantine, or freight embargo, may have been in effect for many years as a permanent policy of the controlling government. A strike may be an old and chronic one whose settlement within an early period is not expected. In any of these situations there could be no possible reason why the contractor, who of course anticipated these obstacles in his estimate of time and cost, should have his time extended because of them.
>
> "The same is true of high water or 'floods'. The normally expected high water in a stream over the course of a year, being foreseeable, is not an 'unforeseeable' cause of delay. Here plaintiff's vice-president testified that in making its bid plaintiff took into consideration the fact that there would be high water and that when there was, work on the levee would stop. . . ."

And Justice Murphy goes on to say:

> "A logical application of the decision below would even excuse delays from the causes listed although they were within the control, or caused by the fault of the contractor, and this despite the proviso's requirement that the events be "beyond the control and without the fault or negligence of the contractor." If fire is always an excuse, a contractor is free to use inflammable materials in a tinder-box factory and escape any damages for delay due to a resulting fire. Any contractor could shut his eyes to the extremest probability that any of the listed events might occur, submit a low bid, and then take his own good time to finish the work free of the compulsion of mounting damages, thus making the time fixed for completion practically meaningless and depriving the Government of all recompense for the delay."

An interesting by-product of this case is the possibility that findings by the Contracting Officer may perhaps **not** be final. It is true that the second proviso of Article 9 reads:

> **"Provided further,** That the contractor shall within ten days from the beginning of any such delay notify the contracting officer in writing of the causes of delay, who shall ascertain the facts and the extent of the delay, and his finding of the facts thereon shall be final and conclusive on the parties thereto, subject only to appeal, within thirty days, by the contract to the head of the department concerned, whose decision on such appeal as to the facts of delay shall be final and conclusive on the parties hereto."

But Justice Murphy stated in this connection:

> "The contracting officer found that 183 days of delay caused by high water were due to conditions normally to be expected. No appeal appears to have been taken from his decision to the head of the department, and it is not clear whether his findings were communicated to respondent so that it might have appealed."

and sent the case back for determination as to whether the findings were final. The implication is that, unless the contractor was given a reasonable opportunity to appeal from the findings, they are not binding. At this stage of the litigation the case was dropped, so this point never was decided.

Reverting to the main point of the

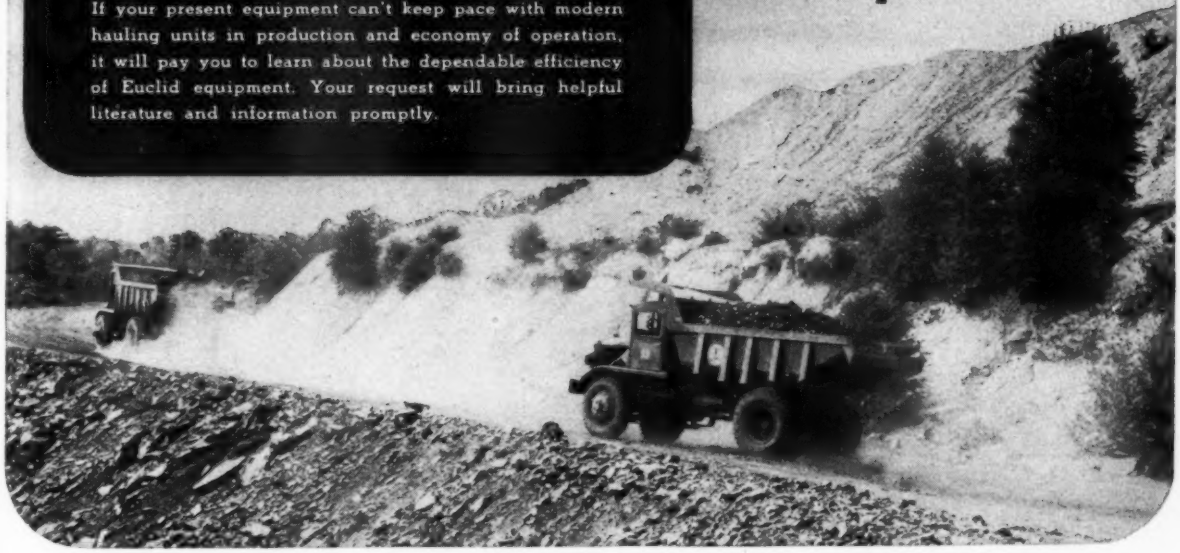
(*Continued on page 160*)

MORE PRODUCTION ON Short AND Long Hauls

Most mine, quarry and construction jobs require off-the-highway hauling equipment that can handle both short and long haul work efficiently. If equipment investment and operating costs are to be kept at a minimum, hauling units must be able to do the tough jobs as well as the easy ones.

Rear-Dump and Bottom-Dump EUCLIDS are designed and constructed for just one purpose — to move large loads of earth, rock, coal, ore and other materials on off-the-highway hauls. Their rugged construction, ample power for steep grades and difficult hauls, ease of operation and speed on the haul road are reasons why Euclids move more tons or yards per hour on short or long hauls.

If your present equipment can't keep pace with modern hauling units in production and economy of operation, it will pay you to learn about the dependable efficiency of Euclid equipment. Your request will bring helpful literature and information promptly.



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Take Sale Restrictions Off 25 Equipment Items

Twenty-five items of construction equipment, which formerly could be sold to purchasers other than war agencies only upon specific authorization by the War Production Board, may now be sold without this restriction, WPB announced. Production and distribution controls over the types of construction equipment the major portion of which is needed by war agencies remain unchanged.

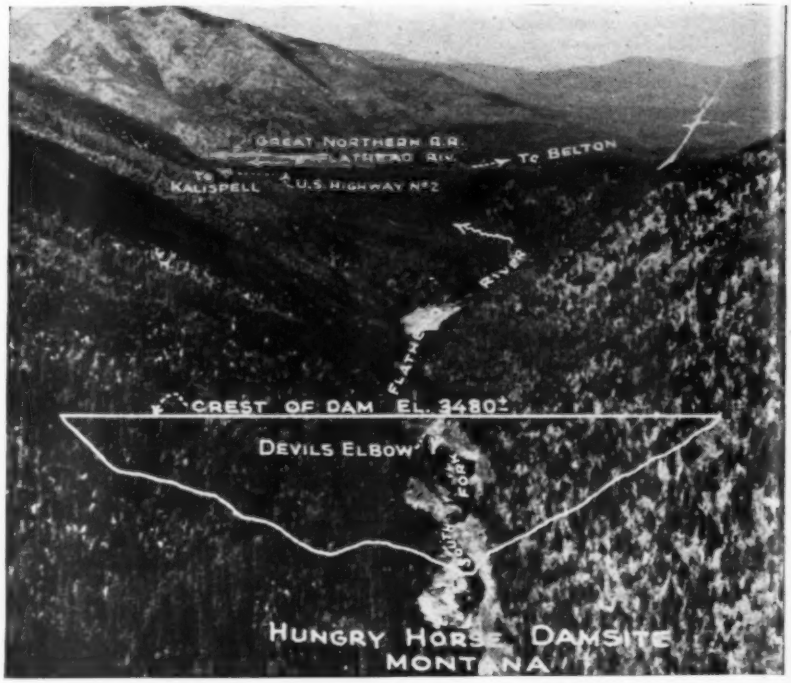
Order L-192 as amended (January 17) transfers the 25 items of equipment from Schedule A to Schedule B. Schedule A items may be sold to war agencies without restriction and to other purchasers only on specific WPB authorization, application for which must be made on Form WPB-1319 filed in WPB field offices. Schedule B items formerly could be sold only on purchase orders rated AA-5 or better. This rating requirement has been removed from the amended order.

Because of limited supply, however, only essential needs for Schedule B items can be filled, and it will in general not be possible to purchase these items without preference ratings, WPB Construction Machinery Division officials said. (Application for ratings may be made to the prospective purchaser's nearest WPB field office on Form WPB-541.)

No increase in production of construction machinery for civilian use will result from the current amendment to L-192, Division officials pointed out. Its chief effect is to simplify purchasing procedure.

Items of equipment transferred from Schedule A to Schedule B are:

Batchers, construction material.
Batching plants, construction type.
Bins, construction material, portable and stationary type.
Bulk cement handling plants.
Distributors, bituminous.
Distributors, water (street sprinklers and flushers).
Draglines (slack line).
Finishers, concrete paving.
Hoists, contractors and material handling exceeding 6,000 pounds line pull at 250 FPM line speed or exceeding 1,300,000 foot pounds effort based on second wrap of cable.
Jacks, mud.
Logging arches, tractor drawn.
Mixers, concrete construction, above 7 cubic feet.
Mixers, concrete truck or agitator type (with or without elevating towers).
Pavers, concrete.
Plants, soil stabilizing.
Plows, snow (rotary and blower types).
Plows, snow (V and blade types) truck, grader or railroad mounted or mounted on tractors of more than 25 HP, including wings.
Pumps, concrete (except for well cementing).
Pumps, portable engine or electric-motor driven units mounted on skids, with or without handles, or trailer mounted larger than 90,000 gallons per hour, self priming centrifugal pumps, horizontal or vertical triplex piston road pumps, ordinarily used for contractor's purposes or by contractors for dewatering and supply.
Scrapers, carrying and hauling, both drawn and self-propelled, under 2 cubic yards struck capacity.
Sprayers (maintenance units) bituminous material (over 300 gallon capacity).
Spreaders, concrete paving.
Wagons, crawler trailer (contractors, logging, cane, etc.)
Washing and screening plants, portable type.
Wheels, crawler trailer (complete assemblies).



• The U. S. Bureau of Reclamation will begin pre-construction work in March on a major unit of the comprehensive plan for the full utilization of the water resources of the Columbia River system — the Hungry Horse Dam, on the South Fork of the Flathead River in northwestern Montana. This aerial view shows the proposed site. (The river is flowing toward the upper part of the photograph.) The completed structure, 450 to 500 feet high, will store 1½ million acre-feet of water for irrigation, production of power at the dam, and increasing the firm output of existing downstream plants, including Grand Coulee, and also will provide flood control benefits and navigation improvement.

Bureau of Reclamation Photo

• Bucyrus-Erie 3-cu. yd. dragline digging a trench for runway drainage pipes in Greenland.

Official Corps of Engineers Photo

Status of Reclamation Projects in California

The U. S. Bureau of Reclamation faces the new year under call to undertake wide-spread conservation works on several new fronts in northern California. The Bureau's 1945 assignments, according to Regional Director Charles E. Carey, include the following:

1. Shasta Dam: continued work on the Bureau's $360,000,000 Central Val-

ley project. The year's end was marked by completion of the concrete portion of great Shasta Dam, with the pouring of the last bucketful of concrete on the roadway across the crest of the dam, and the finishing of the elevator houses. Yet to be installed are drum gates, needle valves, elevators, additional power generators and turbines, and other machinery.

2. Friant Dam: the installation of certain gates, cranes, and valves approved by War Production Board and sufficient for the partial emergency operation of the reservoir has now been completed on Friant Dam. The spillway drum gates and permanent river and canal outlet valves are yet to be installed.

3. Other C.V.P. Works: behind both Shasta and Friant dams the run-offs from the winter rains are being stored for next summer's irrigation. Construction of the last 17 miles of the Madera Canal is nearly finished. Included in this year's C.V.P. work are continuation of the surveys for the Friant-Kern Canal, final plans for the Delta Cross Channel to carry Sacramento River water across the Delta, and continued survey work on the Delta-Mendota Canal to carry this water a distance of 105 miles along the West Side of the San Joaquin Valley to Mendota Pool. Depending upon release of men and material by WMC and WPB, construction work may be started on the Friant-Kern Canal, to carry Millerton Lake water to the Upper San Joaquin Valley. The Congress has made available $7,000,000 to start this work, and the Bureau is ready to begin construction immediately on being given authority to proceed. Authorized C.V.P. works still to be completed or constructed are: Contra Costa Canal and lateral system; Keswick Dam and power plant; West Side and other transmission lines and a standby steam power plant; Delta Cross Channel and Delta - Mendota Canal; Friant - Kern Canal and the Kings River development.

4. Klamath Project: an extensive construction program involving distribution and drainage works, including five pumping plants, are under way to increase the project's irrigated acreage.

• Lined up on a dock ready to be loaded on Liberty ships this array of tractor equipment will be shipped to various Pacific battle areas.

5. Basin Report: early submission to Congress of the Bureau's Central Valley Basin Report. This report will embrace postwar projects looking to the building of multiple-purpose dams and other works for the storage and beneficial use of all the waters in the Central Valley basin. The report is undergoing final stages of preparation and will be ready for submission to Congress this month along with the Bureau's other basin reports. The California program contemplates the expenditure of more than $600,000,000 in such works immediately after the war, providing for irrigation and domestic water supplies; low-cost power for industry, flood control, navigation, fish and wildlife conservation, and recreation—all looking toward the general expansion of the rural and industrial economy of California and jobs for de-

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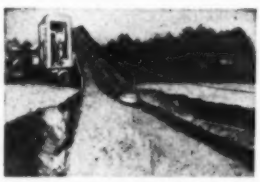

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mobilized war workers and servicemen.

6. Special investigations, which will include among others the following:

Fresno-Chowchilla river development: by unanimous vote the directors of the Madera Irrigation District have just requested the Bureau to take early action to develop additional irrigation water and power on these two rivers in connection with Central Valley project's Friant Dam and Madera Canal storage and distribution works.

San Joaquin Valley West Side development: under a 50-50 cooperative financing arrangement with the West Side Land Owners Association, the Bureau is studying means of new and supplemental irrigation for 500,000 acres of rich lands south of Mendota. These studies will develop sources of water to be conveyed via the Delta — some from Sacramento River, and some, possibly, from the American River project —and distribution works to replenish the falling water table. Some 300,000 acres are being irrigated now but need supplemental water.

Yolo and Solano Counties: studies are about completed looking to an important water conservation project in these two counties. This project calls for three dams to hold back the flood water of Putah and Cache creeks to assure a dependable water supply for more than 300,000 acres of rich lands on the West Side of the lower Sacramento Valley, as well as domestic water supplies for the region's cities.

Russian River Basin: studies now are under way covering possible development for irrigation, power, flood control, and improved recreational facilities on the Russian River. This development would provide irrigation for about 40,000 acres of land near Ukiah, Healdsburg, and Santa Rosa, and would regulate the flow of the famed recreational stream.

San Luis Obispo County: by resolution the County Board of Supervisors has just requested the Bureau to make an early study of the county's urgent water needs looking to a county-wide development of water for irrigation and domestic use.

Santa Barbara County: under cooperative arrangement with Santa Barbara County, the Bureau is completing a plan for supplementing the domestic supply of the city of Santa Barbara, and the Santa Maria Valley and South Coastal area with irrigation water.

Trinity River development: as an essential part of the Central Valley project, the Bureau is completing studies for diverting Trinity River water into the Sacramento Valley at Keswick Reservoir. The plan calls for two dams, the development of considerable power, and the addition of 600,000 acre-feet annually to the total Sacramento-San Joaquin water supply, after providing for the full requirements of the Trinity basin.

Contractors Protest Use of Highway Funds for Airports

The Maryland Highway Contractors Association assailed as "a breach of faith" a proposal by Gov. Herbert R. O'Conor to divert highway-user tax revenues to finance construction of airports.

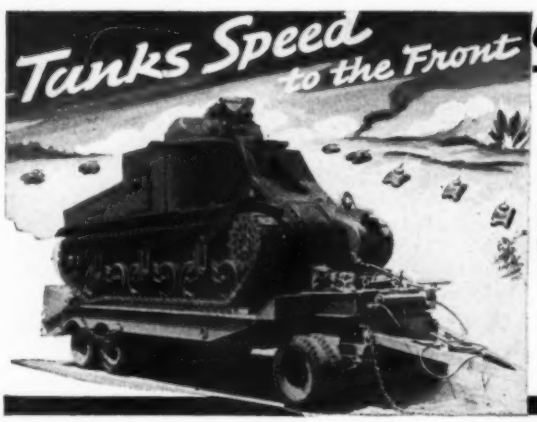
In a telegram January 25 to Governor O'Conor, the contractors asserted it was neither necessary nor desirable to "go headlong into a program of construction of airports," at the expense of state roads and users of the roads.

The association declared that highways and roads throughout Maryland will have to be repaired after the war "to a point where they cease to be a hazard to users, and such work will require much more than the money on hand or in sight."

Maryland will require all its accumulated highway funds, plus current automotive tax revenue, to match the $4,800,000 of federal highway funds allocated to the state, according to the association, which warned that the federal legislation contained penalties against diverting states.

Mechanization of Road-Building in China

The international aspect of postwar highway planning and the need for modern road-building equipment and materials in China is revealed in the following address by Mo-Chih Li, professor of Highway Engineering and Highway Transport at National Tsing Hua University and also Director of



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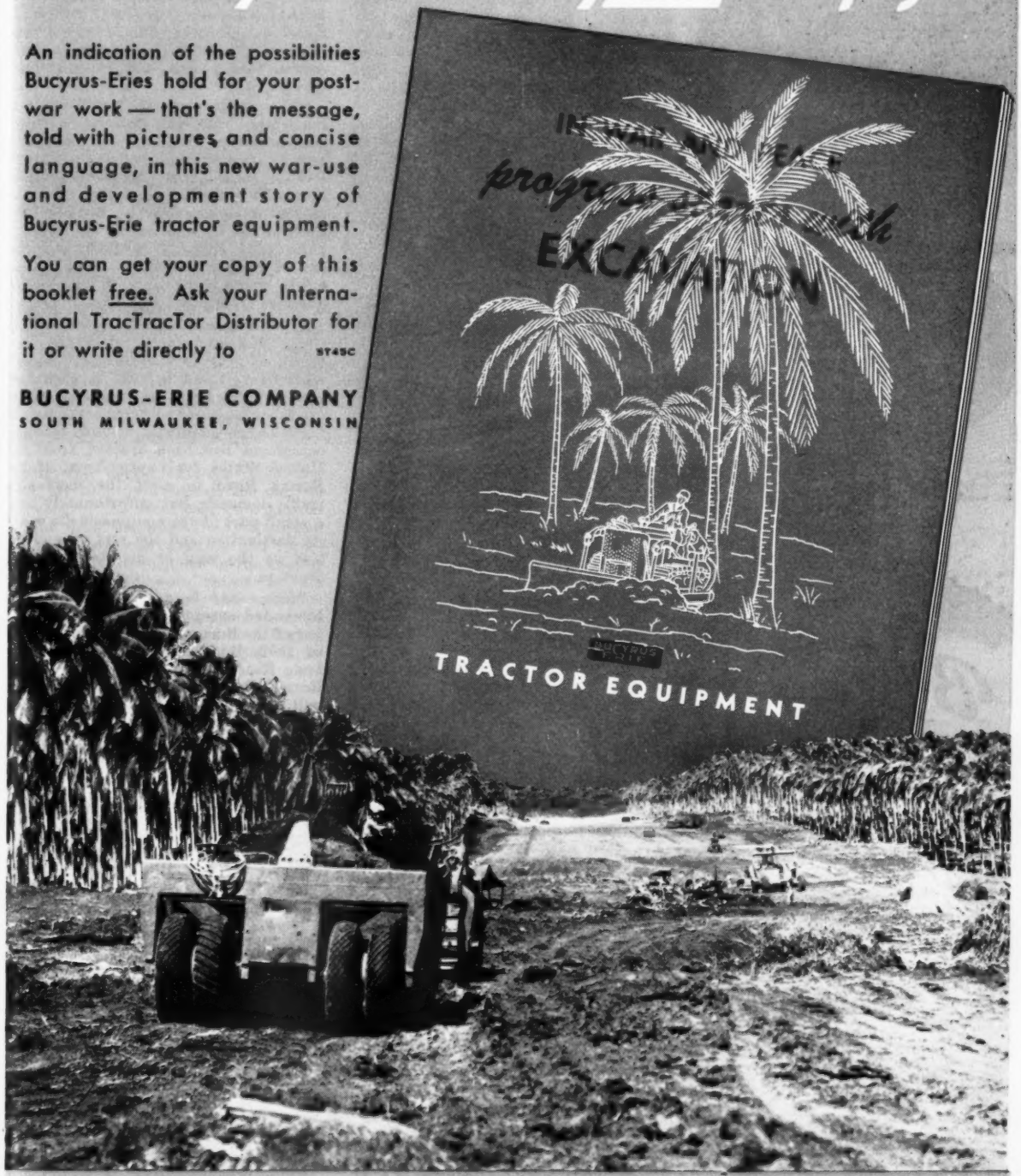

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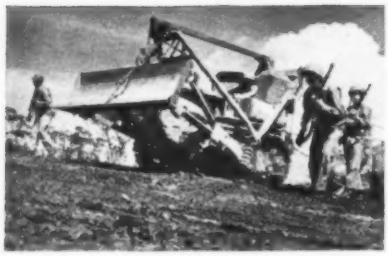


• This armored LeTourneau bulldozer is accompanied by an armed body guard on a Munda airfield being constructed by an Engineer Combat Regiment.

Signal Corps Photo

Research, National Highway Administration, Ministry of Communication, China. The address was read in committee at the 42nd annual convention of the American Road Builders' Association in Chicago in January.

"The modern road-building movement in China, which was started in 1921 when the Nation's total highway mileage was only 736 miles, has since been rising at a fast and steady rate. Just prior to the beginning of the Chinese-Japanese War in 1937, China had a total highway mileage of 68,043 opened to motor traffic. In an interval of 16 years, the rate of progress of road construction increased nearly one hundred times.

"During the almost eight years of war, in spite of all difficulties, China has been making every effort to develop her transportation and communication system. Although the work has been slow and difficult, the transportation and communication system has been steadily developed and improved. Had it not been for this war, the program of reconstruction and industrialization would have been more quickly expedited.

"Motor transportation has played an important rôle in China's wartime transportation. In the vast Southwest and Northwest, where there are very few railroads and navigable rivers, highways provide practically the only means of communication. Between the time of the cutting off of the French-Indo-China Railway in 1940, and the fall of Burma in 1942, China depended solely upon the Burma Road for her supplies from other countries.

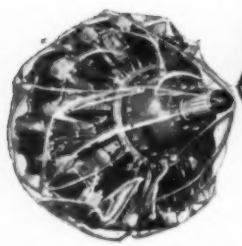
"The toughest road-building problem China has been facing since the outbreak of war is the lack of modern machinery. Hand method is slow and costly, particularly at localities where the labor is scarce and the living cost is high. Large quantities of road-building equipment had been ordered from the United States for improvement of the Burma Road to meet the increasing traffic demands, but unfortunately only a small part of the equipment did reach its destination and the rest was either lost on the way or diverted to other theaters.

"China has been almost completely blockaded except by air since the closing of the Burma Road in the early part of 1942. It is expected that the new Ledo Road will eventually join the old Burma Road and this overland route will be opened to traffic in the near future. Modern road-building equipment will undoubtedly be needed to improve and maintain the road in a serviceable condition.

"Immediately after the war, China should be able, at least, to rehabilitate 75,000 miles of highways and 12,700 miles of railways. Postwar reconstruction and industrialization in China call for, first of all, a modern and efficient transportation and communication system, and highway transportation will undoubtedly play its important role.

"The ultimate goal of land transportation would be 100,000 miles of railways and 1,000,000 miles of highways as originally planned by Dr. Sun Yat-Sen, the Founder of the Chinese Republic. Although it will take many years to reach this goal, these figures represent only one-third of those in the United States and is by no means fantastic, since China, on the other hand, is approximately one-third larger in area than the United States and has a population three and one-half times larger.

"China has spent millions of dollars on the first stage of her highway development since 1921. A total amount of over $90,000,000 was appropriated by the Government to various provinces in the form of loans for the construction of a National highway system alone



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during the period between 1930 and 1939, and this figure comprised only 40 per cent of the total cost of construction of those projects. The balance and the initial costs of grading and right-of-way were not included in the cost of construction and were raised by the Province concerned. Many more millions of dollars will have to be spent in order to bring Chinese highways to a higher standard for economic operation of increasing traffic as well as to build more highways to meet postwar requirements.

"For the purpose of a conservative estimate, it can be stated that roughly an average of 5,000 miles of new highways will be built annually for the first five years, in addition to improvement of many more miles of existing highways to higher standards. It is evident that improvements must be made on a large percentage of present highways, including relocation, reduction of excessive grades and curvature, widening of roadway, building of stronger bridges and culverts, elimination of ferries, improving of road surfaces, and other items. Better highways are just as necessary as more highways.

"Prewar statistics revealed the fact that in 1937, out of 68,000 miles opened to motor traffic, only 15,600 miles, or about 23 per cent had been surfaced. Improvements made on highways during the wartime should raise the percentage of surfaced highways to about 40 per cent. Furthermore, most of the surfaces are of untreaded macadam or gravel which tends to become dusty in dry weather and muddy in wet weather. Although it is an all weather surface, the operating costs of commercial vehicles in particular are exceedingly high. Attempts will also be made to improve some of the comparatively densely-traveled main highways to higher types of road surfaces. At the end of the first five-year postwar period, China should have a grand total of 100,000 miles of good highways.

"Building of more and better highways calls for more road-building equipment and materials. Although China will undoubtedly utilize her immense manpower in her road-building program, it is inevitable that at least certain types of road-building equipment must be used. Some equipment due to its sturdy and powerful construction, surpasses the performance of manpower and sometimes can not be re-

(*Continued on page 148*)

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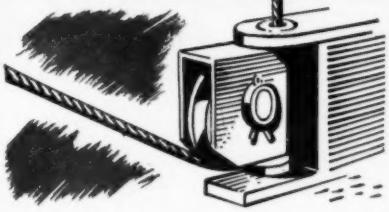

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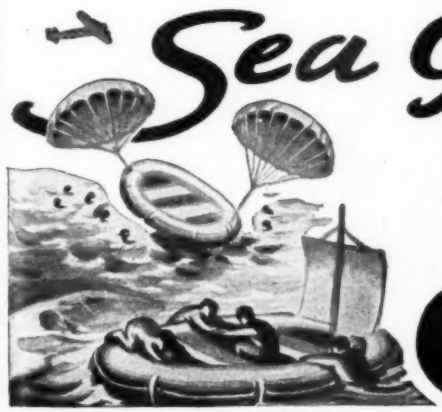

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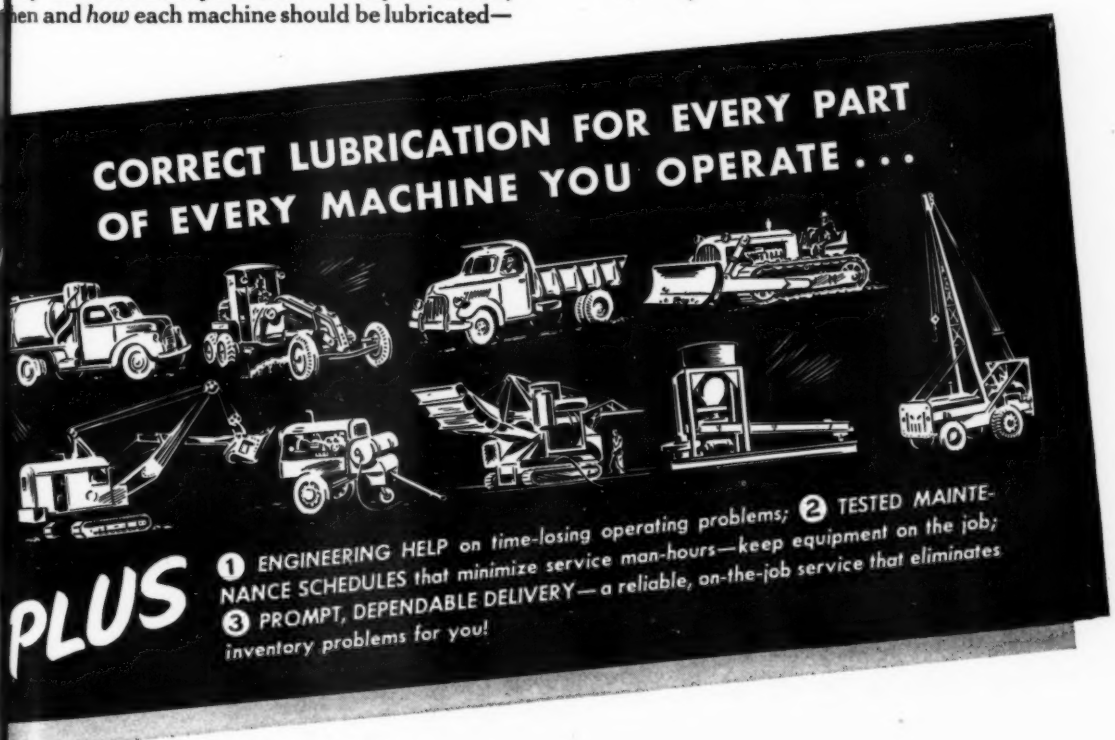
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Shots from the Firing Line

(Continued from page 145)

placed by hand methods. Such are the cases of heavy rollers, derricks, cranes, rock-drilling equipment, etc. Another type of machine used results in definitely better quality of work, as to uniformity, serviceability, and durability.

"In certain cases where the working space is so limited that it is impossible to use a large number of men to carry on the work required, certain types of machines have to be used in order to expedite the work. For example, in clearing land-slides on a narrow side-hill section, bulldozers and shovels may prove to be more advantageous and economical than men. — —

"In any project the work could be expedited and completed in much less time with the use of machinery. In some places where the construction season is short, the use of machinery is especially advantageous.

"Postwar industrialization and reconstruction will draw millions of men, and the cost of labor will be increased. In some localities, labor might even be scarce. Some types of machinery which have proved to be too costly to use in prewar periods may be economically justified after the war. In machine work, only a handful of operators, mechanics and helpers are required. The supervision of such an organization would be much easier than that of the sizable force of laborers required for the same amount of work done by hand.

"It can be seen that the foregoing arguments give only a general overall picture. Factors which influence the use and selection of roadbuilding machinery in each project are as follows: Locality of construction projects; type and nature of work involved; initial and operating cost of machinery; local labor cost; amount of labor available; length of construction season; time of farming season; importance of the project; time limit for completing the project; previous experience and knowledge of the machinery by those concerned; previous training of engineers; and ease or difficulty of convincing highway officials that machinery should be used.

"Since expensive road machinery requires a large investment and the capital of road contractors in China is usually very limited, few contractors would be financially able to use such equipment. Road-building is a governmental enterprise and the highway administrations and bureaus handling the actual construction work will usually buy and own such equipment. Although the use of equipment is determined by economic comparison, due consideration should, however, be given to increased efficiency and speed by the operation of such equipment, and should be weighed in the final selection of methods. Unless the difference in costs between machine and hand methods should be appreciably in favor of the latter, there is no reason why road-building machinery cannot find its field of application in China.

"Ignorance of modern road-building machinery in places where such machinery has never been tried or used, is one of the major obstacles which must be overcome. The psychological and human factors play an important role in the decision of determining the adoption of machinery particularly when the difference in balanced costs is not great. When people know more about road machinery, a tendency to its use will be undoubtedly accentuated. It is my sincere belief and hope that mechanization of road-building in China will be put into effect, at least, in part, in her postwar industrialization and reconstruction."

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Anderson Ranch Dam 55% Completed at End of 1944

Construction of Anderson Ranch dam on the South Fork of the Boise River in southern Idaho, which will become the highest earth-fill structure in the world, was approximately 55 per cent completed at the end of 1944, H. F. Bahmeier, Construction Engineer for the Bureau of Reclamation reported.

During the year, 1,600,000 cu. yds. of earth and rock were added to the structure, increasing the total yardage in place to 3,600,000. When completed, the dam will contain 9,000,000 cu. yds. of material. The height of the compacted embankment above bedrock was in-

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U. S. Signal Corps Photo

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creased to 250 feet, more than half the ultimate height.

The dam is a key unit of the Bureau of Reclamation's comprehensive plan for the development of southwestern Idaho. Multiple-purpose in scope, it will bring a supplemental supply of water to 340,000 acres of highly developed farm land in the fertile Boise Valley, and provide flood control, silt control, and power development. Ultimately the dam will be able to provide irrigation water for a large tract of arid land between Boise and Mountain Home, through an exchange of storage from the Payette to the Boise Basin.

In addition to the large amount of earth and rock in place, approximately 26,000 cubic yards of concrete of the 72,000 required in the outlet tunnel, control structures, and spillway have been placed. Clearing of 4,000 acres of merchantable timber, and brush, in the reservoir area is one-third completed. Construction of approximately 10 to 28 miles of County and Forest Service road adjacent to the reservoir has been completed.

Mr. Bahmeier said that the program for this year calls for the placement of an additional 2,000,000 cu. yds of earth and rock, completion of the intake structure for the outlet works, and the beginning of construction of the spillway. It is estimated that it will be possible to store approximately 45,000 acre-feet of water for the growing season of 1946.

Construction now underway was approved by the War Production Board in the fall of 1943, upon the recommendation of the War Food Administration, after practically all work had been halted for a year by the WPB stop-order of December 26, 1942.

It was anticipated that storage of 45,000 acre-feet would be made available in the spring of 1945, 130,000 acre-feet in 1946, and the full 500,000 acre-feet in 1947. However, because of manpower shortages, lack of replacement parts for equipment, and tires for trucks, the 1944 embankment (earth and rock placing) program was 700,000 cubic yards short of schedule. The average number of men employed during the construction season was only 66 per cent of the total manpower allowed by the War Production Board directive.

When completed, the dam will contain 8,000,000 cu. yds. of compacted earthfill, 1,000,000 cu. yds. of rock, and

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• Buckeye crawler crane works in water driving piles as U. S. Army engineers rebuild a bridge that had been destroyed by the fleeing Nazis in Reuness, France, in their vain attempt to halt the American drive. *U. S. Signal Corps Photo*

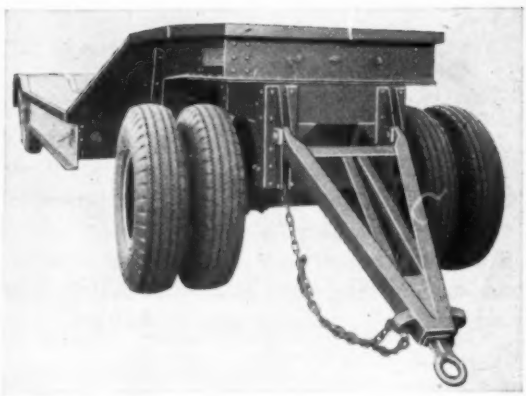
will be 456 feet high, 1,350 feet long at the crest, and 2,500 feet wide at the base. A 30,000-kilowatt power plant, not approved for construction under the WPB program, will be located at the downstream toe of the dam.

The permanent outlet tunnel, now used to divert the flow of the river past the dam site, will be 1,500 feet long and 20 feet in diameter. Its function will be to control the reservoir elevation and to direct water into the proposed power plant. The spillway, to be constructed on the left abutment, will be an open-channel, concrete-lined chute, 53 to 100 feet wide, and 339 feet high, having a maximum discharge of 20,000 cubic feet per second. A spectacular sight will be created during times of overflow when the water plunges down the unusually steep spillway, a distance equivalent to that of a 33-story building.

The body of the dam will be comprised of rolled sandy clay loam, zoned to produce an impervious core supported by stable, free-draining sections. Two concrete cut-off walls, to reduce seepage, extend across the bottom of the dam and up both abutments. The rock under and between the walls is being grouted; that is, a mixture of cement and water is being forced into the rock under high pressure to seal whatever fissures or cracks might be present.

Material for the center or impervious section of the mass is brought to the dam from a nearby pit on a 2-mile long conveyor belt, formerly used in the excavation of overburden at Grand Coulee Dam. The impervious and semi-pervious materials are placed in eight-inch lay-

LA CROSSE COW BOYS



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ers, and after being moistened slightly, are rolled 12 times with a 20-ton sheeps foot roller. The resultant compacted material weighs almost as much per cubic foot as average concrete.

Construction of Anderson Ranch Dam was begun in August 1941. When the War Production Board ordered the work to halt in the fall of 1942, about 32.6 per cent of the construction had been completed. The estimated cost of the completed dam, on the basis of pre-war prices, is $13,000,000.

The construction work is being done jointly, on a cost plus fixed fee basis, by the Morrison-Knudsen Co., Inc.; J. F. Shea Co., Inc.; Ford J. Twaits Co.; and Winston Brothers Co.

Elect Skelly ARBA Head

James J. Skelly, Media, Pa., contractor, was elected president of the American Road Builders Association for 1945 to succeed Carl W. Brown, chief engineer, at the annual meeting in Chicago. H. C. Whitehurst, director of Highways for District of Columbia, was re-elected treasurer.

Regional vice-presidents are: Paul B. Rheinhold, Pittsburgh, Pa.; W. A. Young, Macon, Ga.; E. R. Galvin, Massillon, Ohio, and C. H. Purcell, Sacramento, Calif. Newly elected divisional presidents include: Arthur F. Rannsy, Akron, Ohio, County Highway Officials' Division; Nathan L. Smith, Baltimore, Md., Municipal Division; and Charles W. Smith, Pensacola, Fla., Highway Contractors' Division.

Nevada Will be Able to Match Federal Funds

Nevada will be able to match available postwar federal highway aid funds without additional state taxation, it was predicted by Gov. E. P. Carville in a message to the Nevada Legislature.

Terteling Elected Head of Idaho AGC Group

J. W. Terteling of Boise was elected president of the Idaho branch of the Associated General Contractors at the group's recent annual meeting (Jan. 12-13) in Boise. Also named were W. H. Puckett, vice president, and L. D. Robbins, secretary-treasurer. Terteling succeeds Paul Vernon as president.

Recommend 30 Million More For Flood Control

Renewed recognition of the importance of the Mississippi River in war as in peace was given by the Bureau of the Budget in January, when it recommended to Congress an appropriation of $30,000,000 for flood control construction in the alluvial valley during the fiscal year beginning July 1, 1945.

This is substantially the same amount as was appropriated for the current fiscal year, and will enable the Corps of Engineers to put under construction another large program of levee enlargement, revetment and dredging for flood control and navigation.

For general flood control outside the alluvial valley, the Budget Bureau recommended an appropriation of $6,993,000 for the maintenance of existing structures, and $7,044,000 for new construction. The latter sum already has

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Complete integrated units, each designed for specific performance.

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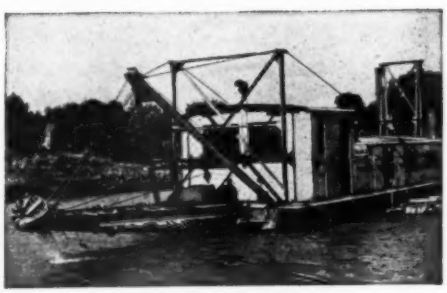

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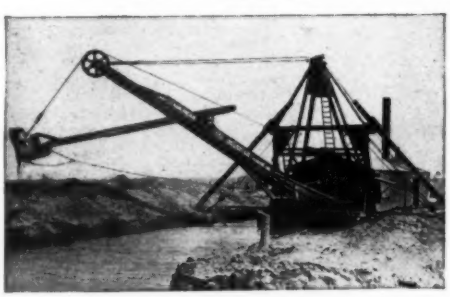

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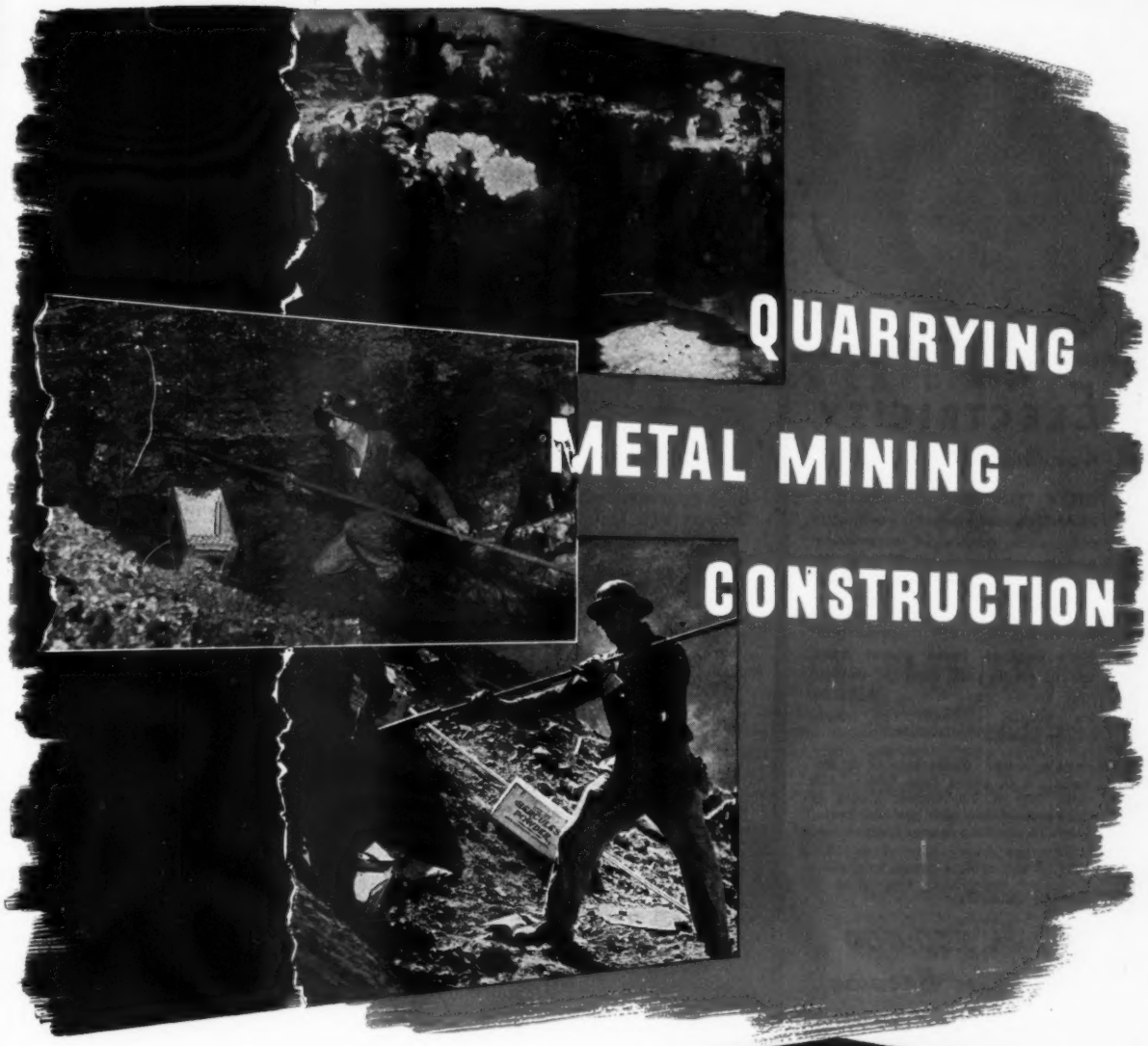

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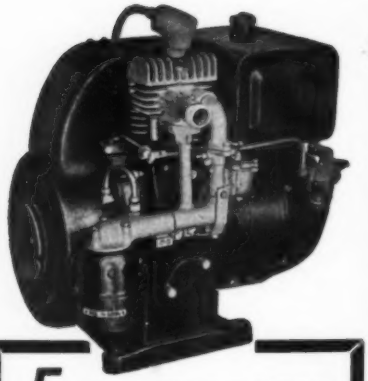

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• Caterpillar Diesel D6 tractors pulling Athey trailers loaded with supplies ashore on Kiska in the Aleutians.

Official U. S. Navy Photo

been appropriated by Congress in a deficiency bill. It is intended largely for rebuilding levees on the Mississippi River between St. Louis and Cape Girardeau and on the Wabash River, in both of which regions recurring floods have almost wrecked existing structures.

The Budget Bureau approved appropriations of $3,970,000 for new river and harbor work and $47,388,000 for river and harbor maintenance.

Prepare Plans for Excavating Work at Boulder Dam

Plans and specifications for construction work at Boulder Dam, involving 1,000,000 cu. yds. of excavation are now being prepared by the Bureau of Reclamation at Denver, Col.

The excavation includes 200,000 yards of dredging in the river below the power houses, 600,000 cu. yds. of tunnel muck disposal, and 200,000 yards of rock excavation open-cutting some of the tunnels.

Maryland's Postwar Projects Total $163,784,119

Gov. Herbert R. O'Conor told the opening session of the 1945 Maryland Legislature that an inventory of 539 postwar public works projects totaling $163,784,119, of which $61,420,530 represents highway planning and $17,397,918 state capital improvements, had been developed by the State Commission on Postwar Reconstruction and Development in conjunction with public agencies of the state, county and local governments. He said approximately 60 per cent of the state's projected program had been completely planned or was on drawing boards.

Propose to Convert Canal To Highway

The Illinois Legislative Council recently approved a report recommending conversion of the old Illinois and Michigan canal to an express highway between Chicago and Joliet. The canal was completed in 1848, following a Federal land grant in 1822 and is 84 miles long, varying in width from 40 to 120 feet. The original Federal grant also included a 90-foot strip of land on each side of the waterway which would provide a highway right-of-way of more than 200 feet.

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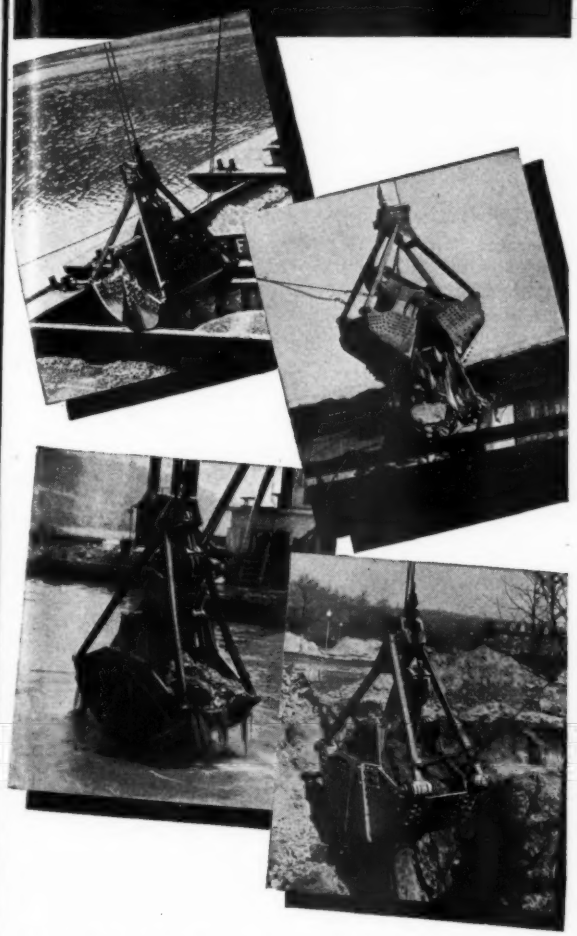

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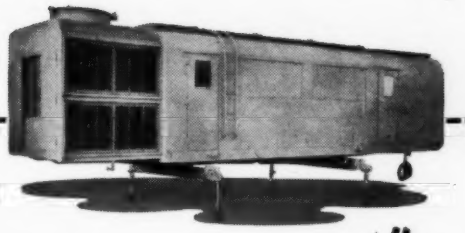

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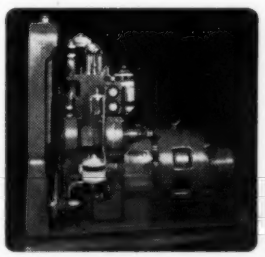
If there are times when *your* power requirements are below normal, take a tip from the Navy. Cut operating and maintenance costs. Install a Sheppard Diesel Auxiliary Generating Set. It provides low-cost electricity . . . low-cost power . . . because it operates efficiently on the cheapest fuel obtainable. A limited number are now available. Let us advise you how to obtain WPB approval. Mail coupon for free literature today.



5 KW Model 7 Sheppard Diesel Generating Set used as a standby for lighting in and around the 600 KW portable power plant shown above. 4" bore x 5" stroke; single cylinder; rated at 8 HP at 1200 RPM; variable speed governor control with 4% regulation; simplified Sheppard Fuel Injection System.

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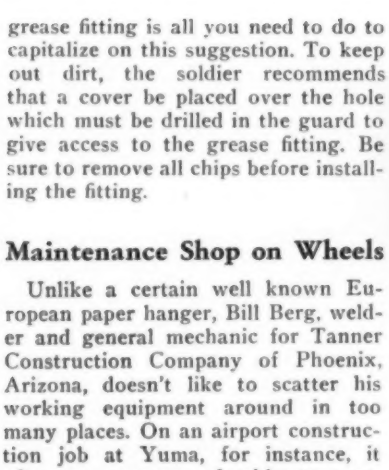
Field NOTES

Easy Track Adjustments

In a letter to the Army magazine, Maintenance Engineer, T/5 Paul A. Kroop describes how he makes life easier for himself by installing a grease fitting in the adjusting nut on his Caterpillar tractor.

"Lubrication will keep rust off the screw threads and make the adjusting screw easy to turn without the aid of the wrench," Kroop wrote.

Drilling a hole in the track adjusting screw nut and tapping to fit a



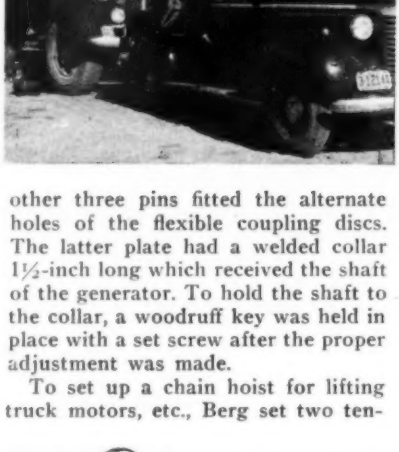
grease fitting is all you need to do to capitalize on this suggestion. To keep out dirt, the soldier recommends that a cover be placed over the hole which must be drilled in the guard to give access to the grease fitting. Be sure to remove all chips before installing the fitting.

Maintenance Shop on Wheels

Unlike a certain well known European paper hanger, Bill Berg, welder and general mechanic for Tanner Construction Company of Phoenix, Arizona, doesn't like to scatter his working equipment around in too many places. On an airport construction job at Yuma, for instance, it often was necessary for him to overhaul a truck motor, rebuild shovel teeth, or make a hurry-up cut and weld job on a truck or scraper. Sometimes the rush work called him to the rock plant 12 miles away. In order to handle all of these jobs, Bill gathered various equipment and fitted them to his ¾-ton Chevrolet pickup truck for a maintenance shop on wheels that answers every construction man's needs.

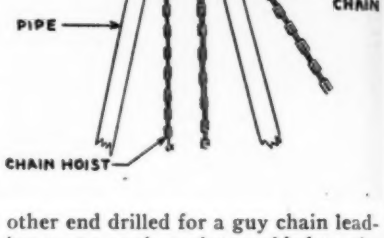
To install the welding machine to his truck, Bill cut the steel body back 22 inches from the front and down to about six inches of the bottom. A Lincoln welding machine powered with a Hercules motor was placed crosswise behind the truck cab. Bill bolted the metal base of the welder to wooden timbers which in turn were bolted to the chassis frame. It was found necessary to weld a metal brace between the chassis frame near the forward edge of the welder base. Since the welding generator had a base consisting of two two-inch angles with a ½" x 3" x 4" plate welded under each at the ends, a bolt through each plate running through a slot in the chassis frame allowed for adjustment to the engine after the two units were in perfect line.

The motor and generator were joined by a flexible coupling but in order to shorten the distance between the two units and still retain flexibility, the flexible coupling discs were applied over six ¾" x 1½" steel pins. Three of the pins were welded to a ⅜-inch metal plate seven inches in diameter bolted to the flywheel of the motor and a similar plate with the



other three pins fitted the alternate holes of the flexible coupling discs. The latter plate had a welded collar 1½-inch long which received the shaft of the generator. To hold the shaft to the collar, a woodruff key was held in place with a set screw after the proper adjustment was made.

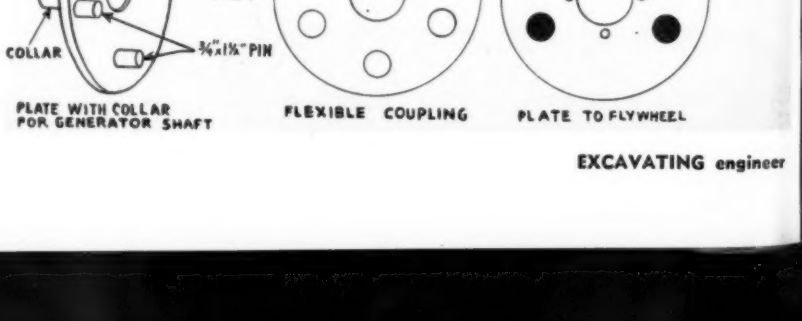
To set up a chain hoist for lifting truck motors, etc., Berg set two ten-foot sections of two-inch pipe into metal recesses welded inside the rear corners of the truck bed. The top ends of the pipe were joined by a special A-frame head tie cut from steel plate and bolted together. The tie lug, V-shaped, had one end drilled for a block and tackle hook and the



other end drilled for a guy chain leading to an anchor plate welded to the extra cross brace (which was welded to the chassis frame behind the generator). The two pins of the tie, ¾-inch plate by about ten inches long, are slipped into the pipes before raised into place and the guy chain adjusted. When traveling with the hoist in place, a secondary chain is used to anchor the hoist hook to the ball of a trailer hitch on the rear of the truck.

The trailer hitch was made from a 30-inch section of four inch channel with the ball bolted through a ½" x 3" boss four inches long, welded to the outer end of the channel. A V-cut made in the flange 18 inches from the inner end of the channel welded to the chassis, and the channel bent and welded gave it a downward slope. A similar cut and weld made the last four inches vertical forming a base for the ball boss braced with a triangular section of plate beneath it.

Also included in the equipment was a vise mounted on the left rear corner of the flaring truck bed by forming a piece of ⅛-inch steel to grip the tubular edge of the bed and extend down along the slope eight inches and bolted. A 1" x ¼" x 16" bar welded to the vise stand and bolted to the



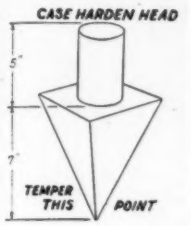
bed below formed an outside brace.

To utilize every piece of material, Berg fashioned the metal cut from the front end of the bed into a tool box and mounted it by welding to the running board.

Jos. C. Coyle.

Rock Splitting Wedge

Jim Stringfellow's contract to furnish rectangular pieces of blue granite for bank paving caused him to devise this tool in his own blacksmith shop to help get out the stone. Old pieces of two-inch or 2½-inch round steel from old drive and piston rods, and other round stock with an approximate tensile strength of 110,000 lbs. were used to make the wedge shown. Ten were kept on hand and about ten were in use.

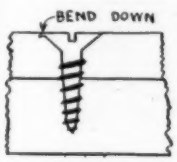


After drilling a hole about six inches deep into the rock to be split, the wedge was set in the hole and driven with a 16-pound sledge. A few sharp blows after the tool wedged tight resulted in blue granite pieces weighing about 150 pounds per stone. Aside from an occasional sharpening and hardening, the tools required no care.

By Raymond P. Day.

Preventing Wood Screws From Vibrating Loose

Where wood screws are subject to heavy strain or severe vibration on excavating machinery, it is common to find them gradually working loose and finally coming out entirely. To hold them securely in place it is easy to drive the screw head with a cold chisel. The bent down portion acts as a lock so that the screw will be difficult to remove except by breaking the wood fibres. Obviously, the best place to drive the edge downward is at that point which will move "against" the grain of the wood and not "with" it.

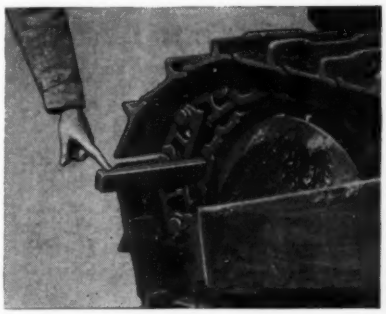


By W. F. Schaphorst

Simplified Track Repairs

Here's a short cut to tractor repairs which allows removal of tracks without disturbing track tension adjustments. It's a useful method for making repairs when a 'dozer frame is in the way because track repairs may be made without removing coverplates, disturbing adjustment of the tension springs, or tightening locknuts.

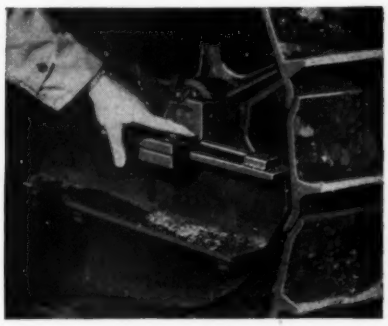
First, weld a steel block on the top flange at the front end of the track frame. Then, whenever minor track repairs are necessary, just place between the sprocket and the track an iron bar, 2" x 4", or any object that will compress the coil tension springs on the front idler when the tractor is driven in reverse (see Fig. 1). This operation usually pulls the front idler back approximately four inches.



• Fig. 1—Iron bar placed between track and sprocket to compress coil tension springs.

Next, place on the track frame flange between the welded block and the front idler collar a heavy strap iron or rod (Fig. 2) of the correct length to hold the front idler spring in the "compressed" position until track repairs can be effected.

The master track pin may now be removed and the entire track can be taken off the sprocket and idlers. To reassemble, follow foregoing procedure in reverse.



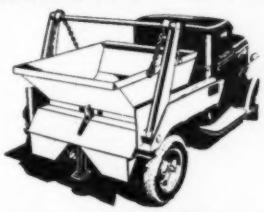
• Fig. 2—Front Idler held back by block placed between idler assembly and steel block welded to track frame.

Ed. Note: The block welded on the track frame must be burned off before major repairs are attempted.

From *Maintenance Engineer*.

Modern Cycle of *HIGH SPEED* Rock Handling

Brooks
LOAD LUGGER
for LOADING, HAULING, DUMPING



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Brooks **EQUIPMENT AND MFG. CO.**

Weggum Mine

(Continued from page 133)

steady flow of ore could be fed to the washing plant or drying plant. A shuttle belt 65-feet long extends along the length of the stacker platform. Running at right angles to this shuttle belt is a cross-running belt extending about 20 feet on both sides of the shuttle belt. The ore is fed from the transfer point to the shuttle belt which in turn feeds the cross-running belt which stockpiles the ore. Four hoppers are built into and flush with the ground, two on one side of the shuttle belt to feed the wash plant and two on the other side to feed the dryer. The hoppers are filled from the stockpiles by a bulldozer.

As the supply of ore is needed in the drying plant, it is carried by a belt starting underground at the dryer hoppers and rising to the dryer. The drying plant, the only one operating on the Mesabi Range, is a rotating tube ten feet in diameter and 90 feet long lined with baffle plates. It has a combustion chamber nine feet wide, 25 feet long and 15 feet high and is fired by two coal stokers. The ore is tumbled and dried in the rotating tube from which it is transferred to a conveyor belt which takes it to the loading pocket.

The ore to the washing plant is carried from the wash plant hoppers under the stacker by a belt starting underground and rising to the top of the wash plant. The ore is crushed and screened and the fine ore treated in Akins classifiers. From the plant it is conveyed to the loading pocket for shipment.

From January 14, 1943 to January 1, 1944 the total material moved at this mine was 2,839,834 cubic yards. From January 1, 1944 to January 1, 1945, 1,503,180 cubic yards of material were moved. Tons of iron ore shipped from January, 1943 to January 1, 1944 were 334,281 and from January 1, 1944 to January 1, 1945, 691,350 tons.

R. W. Whitney is general superintendent, E. S. Mollard, superintendent, and E. L. Bailey, pit foreman. Of the many properties that produced under Butler Brothers, the following 27 mines on the Mesabi and Cuyuna Ranges are in operation today, or held in reserve. Other mines besides the Weggum on the Mesabi Range are: Barbara, David, Harrison, Langdon, North Harrison, Annex, Snyder, Burrall Reserve, Mace No. 2, Patrick-Ann, South Agnew, Wyman Reserve, Carol, Halobe, La Rue, North Harrison, Galbraith, Kevin, Quinn and Theodore. Mines on the Cuyuna Range are the Algoma, Joan No. 4, Merritt No. 2, Ferro, Louise, Whitmarsh, Hunter and Merritt No. 1.

Government Contracts

(Continued from page 138)

decision, namely that unusual and unexpected events are no excuse for delay in performing a government contract, due to the presence of the weasel word "unforeseeable" in Article 9.

The action to this decision was immediate. Many contractors thereafter inserted in all their bids the condition that the word "unforeseeable" must be stricken from Article 9. Each individual contract had to be referred higher-up by the Contracting Officer, to obtain permission to make this deletion.

Soon this situation so slowed-up the awarding of contracts that the War Department issued blanket authority to Contracting Officers to delete the objected word, whenever the contractor insisted. And, as a further step toward fairness, the War Department also authorized the deletion of the requirement that excusable delays must be reported within ten days of their start. (See Army Procurement Regulations 3, pars. 352.1 and 352.2).

But obviously this gave the more belligerent contractors an unfair advantage over their meeker competitors. So the final step was taken of omitting the word "unforeseeable" and the 10-day reporting provision from all printed contract forms.

The foregoing discussion relates primarily to **supply** contracts. But a similar development appears to have taken place in connection with **construction** contracts, which are the sort of government contracts in which the readers of this magazine are primarily interested.

The present status of **construction** contracts is that Par. 703.35(q)(2) of Orders and Regulations, Corps of Engineers, U. S. Army, prescribes that **both** of the changes above discussed **must** be made in all construction contracts, unless the Contracting Officer obtains the permission of the Division Engineer to leave the objectionable provisions in.

However, many of the old forms are still in use.

Accordingly contractors, both supply and construction, are advised to take care to include in their bids the express condition that the word "unforeseeable" and the 10-day reporting provision be omitted or deleted from the Delays-Damages clause; and should check the resulting contract, and refuse to accept it unless this deleting or omitting has been done. In checking, note that the word "unforeseeable" occurs **twice** in some forms, and hence should be deleted from both occurrences.

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Y-210

SEE OPPOSITE PAGE

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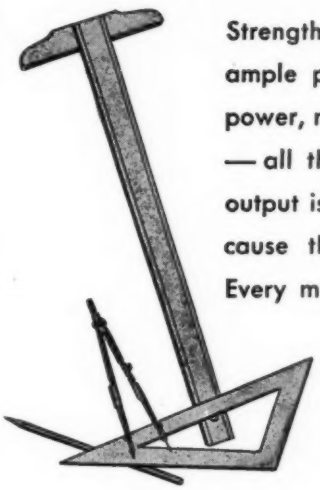

Strength without excessive weight, ample power without wasted horsepower, maximum speed, top efficiency — all that adds up to profit-making output is yours with Bucyrus-Eries because they're right for their work. Every model is individually designed, with just the right combination of power, strength, and weight to do the job of handling its dipper load. That means low maintenance, too, because there's no overstressing of gears and shafts — none of the excessive wear that comes with makeshift models.

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NOT in the Contract

"My, how you've changed! You used to have thick, black hair, and now you're bald. You used to have a florid complexion, and now you're pale. You used to be chunky, and now you're skinny. I'm really surprised at the change, Mr. Jones."

"But I'm not Mr. Jones."

"Heavens! You mean to say you've changed your name too!"

A kindly old gentleman was trying to stop two boys from fighting.

"Will you stop if I give each of you a quarter?" he asked.

And one of them came back with: "Why not make it four bits for the winner?"

"All right back there?" shouted the bus driver.

"No. Wait 'til I get my clothes on!" replied a feminine voice.

So the driver lead the stampede to the rear and watched a girl get on with a basket of laundry.

Suitor: "I wish to marry your daughter, sir."

Dad: "Do you drink, young man?"

Suitor: "Thanks, a lot, but let's settle this other thing first."

Little Claude's mother had reluctantly allowed her precious child to attend public school. She gave the teacher a long list of instructions. "My Claude is so sensitive," she explained, "that when he is naughty you mustn't punish him. Just slap the boy next to him. That will frighten Claude."

Customer (in drug store on Sunday morning) — "Would you please give me two nickels for a dime?"

Druggist—"Here you are and I hope you enjoy the sermon."

Golf is a game in which a ball 1½ inches in diameter is placed on another ball 8000 miles in diameter. The object is to hit the small ball, but not the large one.

Judge: "Your age, madam?"

Woman witness: "Thirty years."

Judge (incredulously): "Frankly, I think you will have difficulty proving that."

Woman witness (angrily): "Well, you can't prove otherwise. The church where my birth was recorded burned down in 1895."

"They're just blasting at the quarry. You'll get used to it!"

The Forgotten Man

When the long day's work is over
And you go back into town,
You limp into a restaurant
And you find a place to settle down.
You're dusty, hot and sweaty
And as tired as homemade sin
And the waitress looks you over
Like the cat had drug you in.
When the dressed up lads and lassies
Curl their lips and sneer
Then you know just what they're thinking
You're a G— D— Engineer.

When the contract's going badly
And the Supt's. been on a spree,
And there's not a bit of progress made
That anyone can see,
When the truck has knocked the stakes out
And a foreman's just been fired.
And a wild eyed, drunken skinner's
Got his cat completely mired.
When the equipment's all gone haywire
And the whole job's out of gear,
Who gets the blame for everything?
Sure, the G— D— Engineer.

Yet when cyclones, floods and dust storms
Leave the nation in Distress,
When the roads have gone to pieces
And the country's in a mess,
When new bridges, dams and hiways
Must be built to save the day,
And someone has to hit the rough
To map "The Right of Way,"
When there's jobs that need a doin'
That fill men's souls with fears,
Then the U. S. sends an S. O. S.
For some G— D— Engineers.

When you go home for the weekend
And your wife is feeling blue,
The kids have caught the measles
And the rent has fallen due,
The yard is rough and wooly
Like it never has been mowed,
And your desk is piled with statements,
For most of the check is owed,
Then the world looks dark and dismal
But there's one thing mighty Clear
Life ain't no bed of roses
For a G— D — Engineer.

— Reprinted from "Cross Roads."

"Did anyone drop a roll of bills with a rubber band around them?"

"Yes, I did," said several voices in the bank lobby.

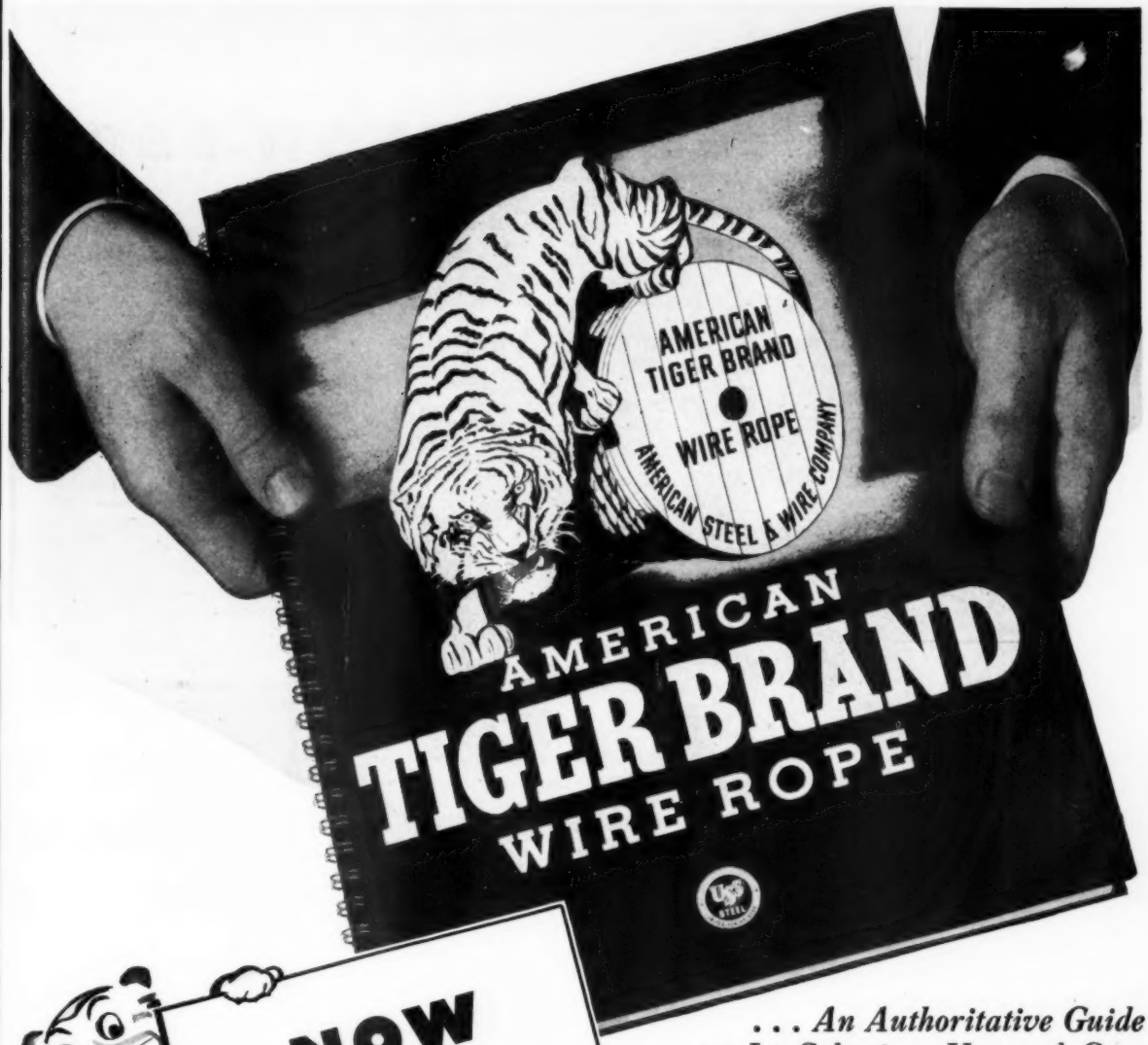
"Well, I just picked up the rubber band," said the old gentleman calmly.

It was the eve of their wedding and he was angry because his bride-to-be was neglecting him in the bustle of last-minute preparations.

"But, darling," she soothed, "if our wedding is to be a success we mustn't overlook the most insignificant detail."

"Oh, don't worry about that. I'll be there."

Some one once said that a good way to test the quality of whiskey is to pass an electric current through a quart of the stuff. If the current causes a precipitation of lye, tin, arsenic, iron slag and alum, the whiskey is fair. If, however, the liquor chases the current back to the generator, you've got good whiskey.



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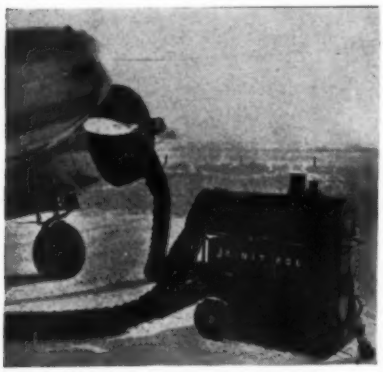
Equipment you ought to KNOW ABOUT

For further details about the equipment on these pages please write to the manufacturer, mentioning Excavating Engineer.

Portable Heater

Manufacturer: Surface Combustion Co., Toledo, Ohio.

Claims: Originally developed for airplanes at Alaska air bases with 50° below zero weather, it is claimed this portable heater unit is capable of applying high heats to excavator, train, truck, auto, and bus motors, and other equipment that is ice or snow bound. Burns gasoline, kerosene, or oil. Manufacturer states the heater safely preheats engines, instruments, windshields, and cabins to permit outdoor construction projects to be carried on in sub-zero weather.



Withholding Tax Chart

Manufacturer: Delbridge Calculating Systems, Inc., 2502-10 Sutton Ave., St. Louis 17, Mo.

Claims: Automatic accurate answers quickly for payroll deduction problems guaranteed with this highly efficient visible-index, hinged card chart system.

Published in four editions for weekly, bi-weekly, semi-monthly, or monthly payrolls. All editions also show the daily or miscellaneous period deductions as a direct answer without multiplication or division. The chart also covers the .18 and 22.5 per cent rates. Sixteen hinged cards, base size 6½"x 9½".

Backfill Tamper

Manufacturer: Gardner - Denver Company, Quincy, Illinois.

Claims: Smooth holding characteristics and the ease with which it can be "walked over the fill" are the outstanding advantages claimed by this new backfill tamper. The tamper is well balanced and will compact backfill to meet the most exacting requirements. Operators claim that it is not necessary to fight the tamper over the fill. This factor, plus its easy holding characteristics, permits them to work faster and more efficiently with less fatigue.

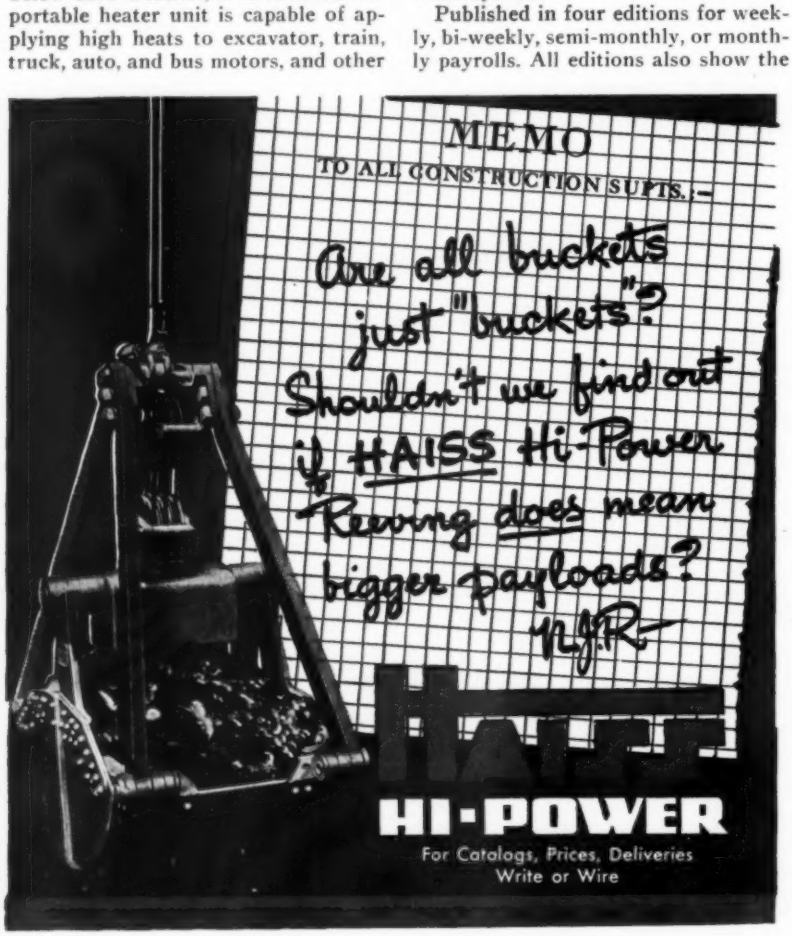
The tamper is powerful, fast, ruggedly designed, simple to maintain. Piston rod packing and pad attachment are conveniently arranged for quick and easy access. There is no tendency toward freezing of the valve or the exhaust when operations are carried on in cold, damp weather.

Flashlight Battery Charger

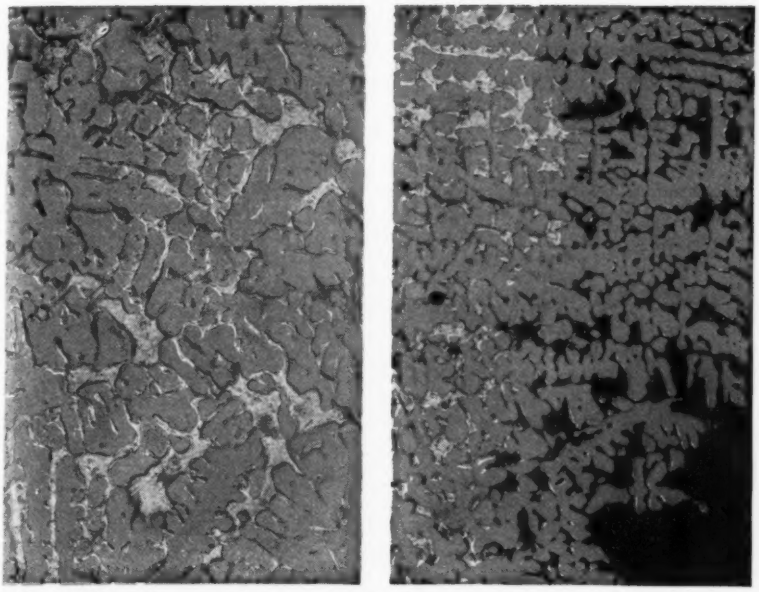
Manufacturer: The B. F. Goodrich Company, Akron, Ohio.

Claims: A single unit charger for its recently introduced rechargeable wet flashlight storage battery can be operated from the ignition system of automobiles, trucks, buses, etc.

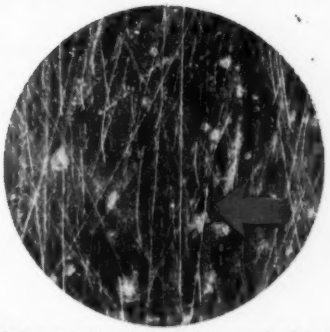
Assures a top charge flashlight battery at all times. Designed for easy attachment on the dash, cowl, or side panel, the charger may be connected so that it does its work with the vehicle either running or idle. For charging while the vehicle is not in use it is attached to the "live" side of the ignition system. It operates on six volts and 12 volts, direct current. The case is made of glossy black plastic.



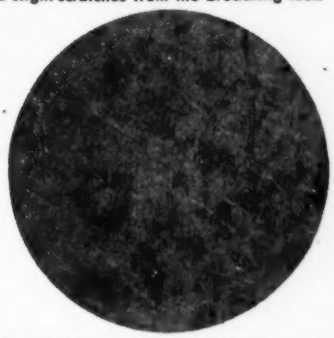
How RPM DELO Eliminates Diesel Bearing Corrosion



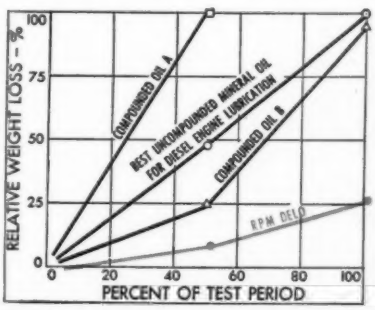
This is what happens to a copper-lead bearing when unstable lubricating oils that become corrosive, attack the lead. The picture on left shows a greatly enlarged cross-section of a new bearing, the copper in red, and lead in light grey. The picture on right shows the same type of bearing with the lead (light grey) eaten away from the surface by corrosion, leaving a copper honeycomb which disintegrates under pressure. RPM DELO Diesel Engine Lubricating Oil eliminates such corrosion of copper-lead or any kind of bearing.



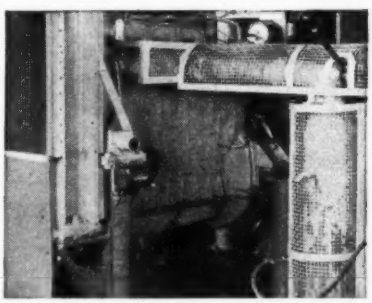
This is a greatly enlarged photograph of a cadmium-silver bearing when new. The arrow points to slight scratches from the broaching tool.



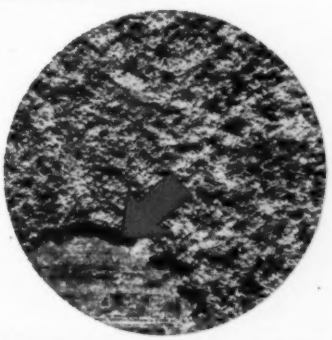
The same type of bearing is shown here, after use with RPM DELO. The bearing surface is in excellent condition.



This chart shows what happens when copper-lead bearing strips are placed in oil which is subjected to oxidizing conditions at a temperature of 280° F. Note the extremely low weight loss with RPM DELO by comparison with other oils, compounded or uncompounded.



This photo shows equipment used in a 500-hour test on RPM DELO by Standard's research organization—RPM DELO has met every laboratory and field test. For specific technical information, write, asking for booklet T-2, Standard of California, San Francisco 20, Calif.



This bearing was used with an unstable lubricating oil that became corrosive in service. Note that the entire surface is pocked and that actual breakdown is occurring on the surface. This can be eliminated by the use of RPM DELO.

Detergent compound to clean engine.

Anti-oxidant to prevent gum and sludge.

Wear-reducing compound.

STANDARD OF CALIFORNIA

RPM DELO has world-wide distribution and is marketed under the following names: RPM DELO, Caltex RPM DELO, Kyso RPM DELO, Signal RPM DELO, Sohio RPM DELO, Imperial RPM DELO

CONCENTRATE

Arc Welding Safety

(Continued from page 137)

fined or concealed spaces where, for example, striking his head may cause temporary loss of his faculties.

He should be particularly careful when working above the ground or floor, since it is significant that many fatalities involve a fall.

Case studies, incomplete as they usually are, give a basis for these recommendations. For example, in all but one of nine reports of accidents, dating from 1934 to 1943, the statement was made that the weather was very hot, or that the victim's clothing was soaking wet. In five of these nine cases, a fall was involved, ranging from a height of 11 feet to the case of a standing man who fell to a steel floor. In every one of them, the electrode holder was uninsulated, and in none was there evidence of contact with any live part other than the electrode holder. Four of the cases involved arc welding operators working in confined spaces.

This discussion can be summarized as follows:

1—Arc welding is not a hazardous occupation, as judged by industrial standards.

2—Electric shock is a relatively infrequent cause of death.

Where electrocution of the welding operator has occurred, one or more of three factors was usually involved:

1. An uninsulated electrode holder.
2. Wet gloves and clothing.
3. A fall.

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There's a complete line to choose from—assuring the right electrode for every job. P&H Welding Electrodes are available in all sizes and types for repair-welding . . . for rebuilding, hard-surfacing to provide unusual resistance to wear, impact and abrasion. Let a P&H field engineer help you with your welding problems. Call your nearest P&H office today, or write for full information.

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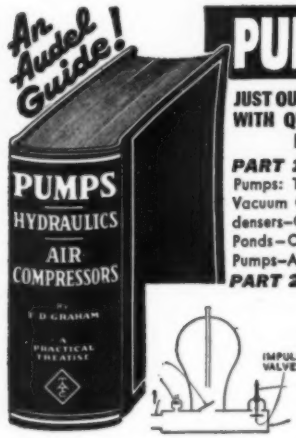

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Where to Get: American Standards Association, 70 East Forty-Fifth Street, New York 17, N. Y. (Price $1.10).